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ABSTRACT

This study was designed to describe and analyze (1) the performance of foreign candidates taking the Graduate Management Admission Test (GMAT) or the Graduate Record Examinations (GRE) Aptitude Test in relation to self-reported primary language (English vs. other), and (2) relationships between performance on the respective admissions tests and performance on the Test of English as a Foreign Languages (TOEFL) for subgroups of foreign admissions-test candidates identified by cross-file matching as having also taken TOEFL. Data were obtained from files maintained by the three testing programs and analyses were based on data for examinees tested during the period from September 1977 through August 1979. (Author/PN)

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TOEFL Research Reports

REPORT 12
OCTOBER 1982

GMAT AND GRE APTITUDE TEST PERFORMANCE IN RELATION TO PRIMARY LANGUAGE AND SCORES ON TOEFL

Kenneth M. Wilson

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TOEFL

EDUCATIONAL TESTING SERVICE

The Test of English as a Foreign Language (TOEFL) was developed in 1963 by a National Council on the Testing of English as a Foreign Language, which was formed through the cooperative effort of over thirty organizations, public and private, that were concerned with testing the English proficiency of non-native speakers of the language applying for admission to institutions in the United States. In 1965, Educational Testing Service (ETS) and the College Board assumed joint responsibility for the program and in 1973 a cooperative arrangement for the operation of the program was entered into by ETS, the College Board, and the Graduate Record Examinations (GRE) Board. The membership of the College Board is composed of schools, colleges, school systems, and educational associations; GRE Board members are associated with graduate education.

ETS administers the TOEFL program under the general direction of a Policy Council that was established by, and is affiliated with, the sponsoring organizations. Members of the Policy Council represent the College Board and the GRE Board and such institutions and agencies as graduate schools of business, junior and community colleges, nonprofit educational exchange agencies, and agencies of the United States government.

A continuing program of research related to TOEFL is carried out under the direction of the TOEFL Research Committee. Its six members include representatives of the Policy Council, the TOEFL Committee of Examiners, and distinguished English-as-a-second-language specialists from the academic community. Currently the committee meets twice yearly to review and approve proposals for test-related research and to set guidelines for the entire scope of the TOEFL research program. Members of the Research Committee serve three-year terms at the invitation of the Policy Council; the chair of the committee serves on the Policy Council.

Because the studies are specific to the test and the testing program, most of the actual research is conducted by ETS staff rather than by outside researchers. However, many projects require the cooperation of other institutions, particularly those with programs in the teaching of English as a foreign or second language. Representatives of such programs who are interested in participating in or conducting TOEFL-related research are invited to contact the TOEFL program office. Local research may sometimes require access to TOEFL data. In such cases, the program may provide this data following approval by the Research Committee. All TOEFL research projects must undergo appropriate ETS review to ascertain that the confidentiality of data will be protected.

Current (1981-82) members of the TOEFL Research Committee include the following:

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GMAT and GRE Aptitude Test Performance in Relation to Primary Language and Scores on TOEFL

Kenneth M. Wilson

Educational Testing Service
Princeton, New Jersey

RR 82-28

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The Study in Brief

This study was designed to describe and analyze (a) the performance of foreign candidates taking the Graduate Management Admission Test (GMAT) or the Graduate Record Examinations (GRE) Aptitude Test in relation to self-reported primary language (English vs. other) and (b) relationships between performance on the respective admissions tests and performance on the Test of English as a Foreign Language (TOEFL) for subgroups of foreign admissions-test candidates identified by cross-file matching as having also taken TOEFL (which is recommended as an aid in assessing the level of proficiency in English of individuals whose English language facility is questionable).

Data for the study were obtained from files maintained by the three testing programs and analyses were based on data for examinees tested during the period from September 1977 through August 1979. The foreign candidates were classified according to self-reported information as being either candidates for whom English was the primary language (EPL candidates) or candidates for whom English was the second language (ESL candidates). EPL candidates were those who reported that they communicated better in English than in any other language (GRE background question) or that the language in which they were most fluent was English (GMAT background question); ESL candidates were those who reported better communication or greatest fluency in a language other than English.

Generally, parallel analyses were conducted for each admissions-test sample. First, attention was focused on differences in the levels and patterns of admissions test scores for foreign EPL and foreign ESL candidates--subgroups assumed to differ in average level of "developed proficiency in English." Then, within each admissions test foreign-candidate sample, detailed analyses were conducted in subsamples comprised of those who also were in the TOEFL candidate pool during the 1977-79 study period--i.e., TOEFL/GRE and TOEFL/GMAT candidates. For the TOEFL/GRE and TOEFL/GMAT subsamples, analyses were conducted to assess the extent and nature of the relationships between scores on the respective admissions tests (both of which include verbal and quantitative measures) and scores on TOEFL; separate analyses were made for EPL and ESL subgroups. Detailed consideration was given to the characteristics of joint distributions of scores on the admissions tests and TOEFL.

Overview of Findings

General trends in findings were quite similar across the respective admissions-test analyses. Major common themes and related conclusions or observations are summarized below.

- The performance of foreign candidates on the quantitative sections of GRE and GMAT equaled that of the respective

general candidate populations; in sharp contrast, however, the verbal admissions-test means of foreign candidates were much lower than average. For example, the verbal test score means of foreign ESL candidates were in the 14-15 percentile range relative to the general GRE/GMAT candidate populations.

- Foreign admissions-test candidates who also take TOEFL are highly selected members of the TOEFL candidate population with respect to TOEFL performance (mean TOEFL total scores of 553 and 559, respectively, for TOEFL/GMAT and TOEFL/GRE candidates).

- As expected, EPL candidates outperformed ESL candidates on TOEFL as well as on the verbal sections of the admissions tests.

- TOEFL total scores, consistent with previous research, were found to be substantially correlated with GMAT verbal scores ($r = .71$) and GRE verbal scores ($r = .70$) but not with GMAT quantitative ($r = .39$) or GRE quantitative ($r = .21$).

- Observed TOEFL/verbal admissions-test correlations were higher for EPL than for ESL subgroups (e.g., TOEFL/GRE verbal coefficients were .74 and .66 and TOEFL/GMAT verbal coefficients were .76 and .68 for EPL and ESL subgroups). Higher coefficients for EPL than for the ESL candidates may be attributed, hypothetically, to the likelihood that, because of the greater level of English proficiency in the EPL subgroups, the verbal admissions tests are psychometrically more appropriate for EPL than for ESL candidates.

- The verbal admissions tests were of considerably greater than average difficulty for TOEFL candidates, for whom TOEFL, in turn, was of considerably less than average difficulty. Measurement efficiency (e.g., reliability) of observed scores tends to be attenuated in groups scoring at extremes on standardized tests generally. Theoretically, therefore, easier "levels" of verbal admissions tests and a somewhat more difficult level of TOEFL would provide more reliable assessments for the TOEFL/admissions-test populations, hence better bases for evaluating observed relationships between TOEFL and standard verbal admissions tests.

- Despite the high average level of difficulty of the verbal admissions tests for foreign TOEFL/admissions test candidates (and for foreign ESL candidates generally), the obtained verbal scores have significant psychometric viability and verbal test performance increased systematically with scores on TOEFL, except in the lowest sector of the joint

distribution of TOEFL/verbal admissions-test scores. As the level of TOEFL scores and English language proficiency increased, TOEFL/verbal-test relationships became more robust--and the average verbal-test performance of TOEFL/admissions-test candidates began to approximate that of the general admissions-test candidate populations.

General Conclusions

Certain general conclusions are offered tentatively as working hypotheses for future consideration:

- Based on findings of the present study and the results of scattered GRE and GMAT validity studies involving both U.S. citizen and foreign examinees, verbal admissions-test score comparisons involving foreign ESL and English-speaking U.S. candidates are not warranted. However, based on the same evidence, the observed verbal scores of different foreign candidates have a useful degree of interpretability in the sense of permitting valid comparisons among them with respect to current level of functional ability to perform English language verbal reasoning tasks such as those reflected in the admissions-test items and those involved in carrying out academic work. For foreign candidates with very low verbal admissions test scores and very low TOEFL scores, limited proficiency in English as a second language per se may be a major factor in accounting for their low verbal scores. Given an opportunity to improve their English proficiency, their functional ability to carry out the verbal tasks required on the admissions tests and in their academic assignments may improve. The amount of time required for substantive improvement in English language proficiency undoubtedly will vary from candidate to candidate.

- The depressed verbal admissions-test performance of foreign ESL candidates relative to that of the general candidate population may be explained as being due in large part to differences between the populations in level of English language proficiency--for example, speed of average verbal performance of foreign candidates is undoubtedly less than that of majority English-speaking candidates. Educational-cultural differences may also be involved, of course.

- Research is needed to establish the level of performance of foreign candidates on English-language verbal admissions tests under essentially unspeeded conditions and to extend evidence bearing on (a) the predictive validity of admissions tests for enrolled foreign students and (b) their level of

academic performance relative to that of majority students with comparable admissions-test scores.

- The study findings provide further evidence of the value of TOEFL for reliably assessing differences in English proficiency for admissions-test candidates whose English language background is questionable and for identifying subgroups within a given candidate population whose verbal admissions-test scores are likely to have differing degrees of usefulness in the admissions process.

- There would appear to be a potentially important role for separate measures of speed and level of performance on verbal tests for foreign ESL candidates.

- Provision of separate reference group score distributions for foreign and citizen admissions test candidates appears to be warranted and needed.

Section 1. Introduction

The Graduate Record Examinations (GRE) Aptitude Test and the Graduate Management Admission Test (GMAT) are intended for use in evaluating the academic qualifications of applicants for admission to graduate departments and graduate schools of management, respectively. The GRE Aptitude Test, which traditionally has provided measures of developed verbal and quantitative reasoning abilities (GRE verbal or GRE-V and GRE quantitative or GRE-Q), was expanded in 1977 to include a measure of developed analytical reasoning ability (GRE analytical or GRE-A). The GMAT provides measures of verbal and quantitative reasoning (GMAT-V and GMAT-Q) and a total score.

The candidate populations taking these tests, and the samples used in standardization and calibration (scaling), are made up predominantly of individuals who share a common acculturation in the sense of having been born, reared, and formally schooled in the United States, with English as the basic language of discourse. However, these admissions testing programs also serve foreign nationals who (a) differ from the typical test taker, and among themselves, with respect to cultural and educational background and (b) in many instances, report that they are less proficient in English than in some other language.

- o During a recent two-year period (September 1977-August 1979), for example, about 23 percent of GMAT registrants who responded to background questions on country of citizenship and language of greatest fluency indicated that they were not U.S. citizens; of these foreign candidates, some 48 percent indicated that they were "most fluent" in a language other than English (were "English is the secondary language" or ESL candidates) while 52 percent were "most fluent" in English (were "English is the primary language" or EPL candidates). Some 10 percent of all GMAT U.S. citizen candidates were self-reported ESL candidates.

- o Among GRE registrants during the same period, about 13 percent were self-reportedly not U.S. citizens; of these foreign registrants, 53 percent reported that they did not "communicate better in English than in any other language" (were ESL candidates) and about 47 percent reported the opposite (were self-reported EPL candidates); of U.S. citizen candidates, almost 3 percent were ESL candidates.

Graduate schools and departments frequently require applicants whose English language proficiency is questionable to submit scores on the Test of English as a Foreign Language (TOEFL), which is designed for use as a measure of English proficiency for individuals whose "native language" is not English. TOEFL yields measures of listening comprehension (ability to understand English as it is spoken in the United States), structure and written expression (mastery of structural and grammatical points in standard written English), and reading comprehension vocabulary (word knowledge and understanding of a variety of reading materials). Scores on the three sections are provided along with a total score.

- TOEFL is standardized and calibrated on a population comprised predominantly of foreign nationals whose native language is not English and who have plans for undergraduate- or graduate-level study in the United States or Canada.

- According to analyses reported in detail elsewhere (Wilson 1982, 1982a), about one-half of TOEFL candidates tested in the September 1977-August 1979 period reported that they did so to facilitate plans to enter a graduate-level degree program in the United States or Canada.

The TOEFL program recommends that scores on TOEFL be used as an aid in interpreting scores on standard admissions tests presented by applicants whose native language is not English and/or in determining whether such applicants need remedial work in English.

This study drew on data from testing files maintained by the GMAT, GRE, and TOEFL programs at Educational Testing Service (ETS) in order to describe and analyze the performance of foreign candidates taking the two admissions tests in relation to relative proficiency in English as reflected (a) by self-reported best or primary language (i.e., English vs. other) and (b) by scores on TOEFL.

The major objectives of the study were:

a. to provide evidence regarding the levels and patterns of scores on GMAT and the GRE Aptitude Test for foreign candidates classified by self-reported best or primary language (English best [or EPL] vs. English not best [or ESL]), and for citizen ESL candidates--i.e., those whose self-reported "best" language is not English

b. to analyze the relationship between scores on the two admissions tests and scores on TOEFL in samples of candidates identified by cross-file matching as having taken both one of the admissions tests and TOEFL.

Data, Samples, and Study Procedures

Data for the study were drawn from testing-program files containing candidate records for the period from September 1977 through August 1979, as follows:

- First, the records of candidates who indicated in response to background questions that they were not citizens of the United States (foreign) or that they were U.S. citizens but communicated better in a language other than English (citizen ESL) were extracted from the GMAT and GRE files. (For convenience these files are referred to as GMAT foreign or GRE foreign files even though they contain records of citizen ESL candidates.)

- Second, using name/sex/birth date identification, records in the GMAT and GRE foreign files were matched with records in the TOEFL file on candidates for the same two-year period to create two subfiles, one for TOEFL/GMAT and the other for TOEFL/GRE candidates--files containing admissions-test and TOEFL records for individuals who took both tests during the same two-year period.

Although the GRE foreign and TOEFL/GRE foreign files included records for the entire two-year period, only data for candidates taking the GRE Aptitude Test during the 1977-78 testing year were retained for further analysis.[1] However, GMAT data for both testing years were included in further analyses.

The records retained for the study were those that included scores on the various tests for self-reported noncitizens of the United States and for U.S. citizens who reported that English was not their primary language, i.e., citizen ESL candidates.

Table 1, which provides information regarding sample size, shows that a significant proportion of GRE and GMAT candidates who also took TOEFL were classified according to their responses to admissions-test background questions as EPL candidates. It was not anticipated that the subpopulation of admissions test candidates taking TOEFL (intended for individuals whose "native language" is not English) would include a significant number of members indicating that they were "most fluent" in English (GMAT) or that they "communicate[d] better in English than in any other language" (GRE). However, prospective graduate students whose "native" language (e.g., that of parents and the larger society during early years) is not English may well be more fluent in English than they are in the historically relevant "native language." It is important to keep in mind, of course, that the EPL/ESL distinction connotes relative proficiency--it is assumed only that the average level of English proficiency for EPL candidates is higher than that for ESL candidates.

- Foreign candidates who report that they are better communicators in English than in another language (EPL candidates) are not necessarily "natively fluent" in English (though they may be expected to exhibit higher scores than their ESL counterparts on a measure of English proficiency such as TOEFL and/or on tests of developed verbal reasoning ability in English; as will be seen later, they do).

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[1]According to information provided by the GRE program, a significant number of candidates, both citizen and foreign, during the 1978-79 testing year may have confused codes used to indicate a GRE Advanced Test field with codes used to designate intended department or field of study. Since certain planned analyses of GRE score data involved classification of candidates by field, it was decided not to include data for the 1978-79 testing year in the analysis.

Table 1

Size of Samples of Foreign (EPL and ESL) and Citizen-ESL Candidates Taking GMAT and GRE Aptitude Tests, Respectively, and Subsamples Taking an Admissions Test and TOEFL

Test/ Citizenship/ primary language	Candidates taking admissions test		Candidates taking admissions test and TOEFL		
	N	Percent*	N	Percent*	Percent Overlap**
GRE-foreign ESL	11,172	44.0	2,451	62.7	21.9
GRE-foreign EPL	11,114	43.8	1,369	35.0	12.3
GRE-Citizen ESL	3,093	12.2	90@	2.3	2.9
(Total GRE)	25,379	(100.0)	3,910	(100.0)	(15.4)
GMAT-foreign ESL	26,576#	37.8	4,245	75.6	16.0
GMAT-foreign EPL	25,096#	35.7	1,312	23.4	5.2
GMAT-Citizen ESL	18,696#	26.6	57@	1.0	0.3
(Total GMAT)	70,368#	(100.1)	5,614	(100.0)	(8.0)

Note: GRE and TOEFL/GRE data are for candidates taking the GRE Aptitude Test during 1977-78; candidates may have taken TOEFL during the period 1977-79. GMAT data are for candidates taking GMAT during 1977-79; GMAT/TOEFL candidates may have taken TOEFL at any time during the same two-year period.

* Base for percentage is number of candidates, by admissions test category.

** Base for percentages is number of candidates, by admissions test category, taking both an admissions test and TOEFL. For example, 2,451 GRE-foreign ESL candidates also took TOEFL, representing 21.9 percent of all GRE-foreign ESL candidates; probably an underestimate of ultimate overlap--e.g., candidates taking TOEFL prior to 9/77 could not be identified since only a two-year file was used for the study.

@ Not included in all analyses.

A 12.5 percent random sample of these candidates is employed in the analysis.

Due to the small size of the citizen ESL subgroups in the TOEFL/GRE and TOEFL/GMAT samples, data for these subgroups were not included in all analyses.

Data: general. For all candidates, scores were available on either the GRE Aptitude Test or the GMAT; scores on TOEFL were available for subgroups within the GRE and GMAT foreign samples. The test variables involved are as outlined below.

GMAT verbal (GMAT-V), scaled 0 - 60
GMAT quantitative (GMAT-Q), scaled 0 - 60
GMAT total (GMAT Total), scaled 200 - 800

GRE verbal (GRE-V) scaled 200 - 800
GRE quantitative (GRE-Q), scaled 200 - 800
GRE analytical (GRE-A), scaled 200 - 800

TOEFL Listening Comprehension, scaled 20 - 80
TOEFL Structure and Written Expression, scaled 20 - 80
TOEFL Reading Comprehension and Vocabulary, scaled 20 - 80
TOEFL Total, scaled 200 - 800

- Only the GRE analytical ability measure is relatively new. Introduced in 1977, this measure is designed to tap student abilities to recognize logical relationships, to draw conclusions from a complex series of statements, to make inferences from statements expressing relationships among abstract entities such as nonverbal or nonnumerical symbols, etc.. This measure correlates above .7 with both GRE-V and GRE-Q (Conrad, Trismen, and Miller, 1977). GRE-A has been found to have validity for predicting first-year grades in graduate school comparable to that of GRE-V and GRE-Q, in samples that excluded foreign students (Wilson, in press).[2]

A variety of nontest data (e.g., answers to a variety of background questions) were available in the admissions-test candidate files. The nontest data actually employed in the present analysis will be considered separately for GMAT and GRE samples. The GMAT and TOEFL/GMAT analyses are described in Section 2; a generally parallel presentation for the GRE and TOEFL/GRE analyses follows in Section 3. Major trends in findings and general conclusions are considered in Section 4.

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[2]Beginning with the 1981-82 testing year, a revised version of the analytical ability measure was introduced.

Section 2. GMAT Foreign and TOEFL/GMAT Candidates: Selected Characteristics and Score Profiles

According to data available on the GMAT general candidate population, the typical GMAT examinee is almost 28 years of age (mean = 27.9 years) and a substantial majority is male (about 74 percent). Less than half of the general candidate population during the three-year period 1975-76 through 1977-78 (46.9 percent) who answered selected GMAT background questions indicated that they planned to study full time, and about one in six reported no "full time employment" when they last took the GMAT (Schrader, 1979).

Table 2 shows comparable data for foreign ESL and foreign EPL candidates (and also citizen ESL candidates) in the GMAT and TOEFL/GMAT samples. In evaluating the data in this table and others, it is important to keep in mind (a) that the GMAT samples include individuals in the TOEFL/GMAT samples, and (b) that the GMAT analysis is based on a 12.5 percent sample of foreign (EPL and ESL) and citizen ESL candidates.

- The GMAT foreign and citizen ESL groups averaged slightly over 27 years of age; the TOEFL/GMAT subgroups were younger, by a year or more on the average, than the average member of the general candidate population.

- About eight in ten foreign EPL and foreign ESL candidates were male, as compared to about 74 percent of all GMAT candidates; only about two-thirds (67.9 percent) of the GMAT citizen ESL candidates were males.

- As compared to the general GMAT candidate population, proportionately more GMAT foreign candidates reported plans to study full time; among citizen ESL candidates, however, only about 44 percent planned full-time study.

- Only about one-tenth (10.7 percent) of citizen ESL candidates reported no full-time work experience as compared to 22 percent of foreign EPL, 26 percent of foreign ESL, and 16.7 percent of GMAT candidates generally.

GMAT Performance

Measures of central tendency and variability (means and standard deviations) for distributions of GMAT verbal, quantitative, and total scores for foreign ESL, foreign EPL, and citizen ESL candidates are shown in Table 3. Several features of these data are noteworthy.

- On GMAT quantitative, the mean scores of foreign candidates do not differ from the mean for the general candidate population; EPL and ESL foreign candidates have identical means on GMAT-Q.

Table 2

Selected Characteristics of Foreign EPL, Foreign ESL, and Citizen-ESL Candidates in the GMAT and TOEFL/GMAT (T/GMAT) Samples, 1977-79

Group	N	Age in years Mean	Male %	Full-time study plan %	No full-time work exp %
General GMAT population*	300,000+	27.9	74.3	46.9	16.7
GMAT foreign-ESL	3,322**	27.4	80.0	89.0	26.0
GMAT foreign-EPL	3,137**	27.2	79.1	64.9	22.0
GMAT citizen-ESL	2,337**	27.3	67.9	44.3	10.7
T/GMAT foreign-ESL	4,245	26.6	81.9	89.0	26.0
T/GMAT foreign-EPL	1,312	25.3	84.6	88.7	29.6
T/GMAT citizen-ESL	57	26.7	61.4	75.0	28.1

*General GMAT population data are from internal program sources. Age data are for candidates tested during 1975-76; other data are for candidates answering the background questions involved during three testing years, 1975-76 through 1977-78.

**Ns are for a 12.5 percent random sample of GMAT foreign (EPL and ESL) and citizen ESL candidates with test scores, 1977-78 and 1978-79 combined.

Note: General GMAT population data include multiple responses or records for repeating candidates.

Table 3

Means and Standard Deviations of GMAT Scores for All Foreign and for Citizen-ESL Candidates, and for Comparable Groups Taking Both GMAT and TOEFL: 1977-78 and 1978-79

Candidate group	N	GMAT-V Mean	GMAT-V SD	GMAT-Q Mean	GMAT-Q SD	GMAT-Total Mean	GMAT-Total SD
All candidates, 1977-1980 *	563,849	26	9	27	8	462	105
GMAT foreign-ESL, 1977-1979	3,322**	15.9	8.0	27.0	9.3	380.4	100.6
GMAT foreign-EPL, 1977-1979	3,137**	24.2	9.8	27.0	9.2	446.6	116.8
GMAT citizen-ESL, 1977-1979	2,337**	27.3	8.5	26.0	8.0	466.0	100.4
T/GMAT foreign-ESL, 1977-1979	4,245	15.7	7.8	28.9	9.2	389.7	98.6
T/GMAT foreign-EPL, 1977-1979	1,312	20.2	9.1	27.5	9.9	417.9	114.8
T/GMAT citizen-ESL, 1977-1979	57	17.6	8.5	23.4	8.9	374.8	107.0

*80-81 GMAT Guide to the Use of GMAT Scores (data for all candidates)

**Ns represent a 12.5 percent random sample of all foreign GMAT candidates and ESL-citizen GMAT candidates for 1977-78 and 1978-79. Ns for T/GMAT samples indicate the total number of candidates identified as having taken both GMAT and TOEFL during the same period.

Note: "All candidate" statistics include multiple records of repeaters.

- Among foreign candidates, those reporting English as the best language have markedly higher mean GMAT verbal scores than their ESL counterparts, but their verbal mean is lower (by about 0.2 standard deviations on the average) than that for the normative candidate population.

- The mean for GMAT citizen ESL candidates on GMAT verbal is actually slightly higher than the mean for all GMAT candidates; their quantitative and total score means are about the same as those of the general GMAT population.

- The pattern of GMAT performance of TOEFL/GMAT foreign candidates is similar to that for the total GMAT foreign population (i.e., EPL candidates higher than ESL on verbal), but the verbal scores for the TOEFL/GMAT foreign EPL group are lower on the average than those for foreign EPL candidates generally.

- The very small group of citizen ESL candidates in the TOEFL/GMAT sample have lower GMAT-Q but somewhat higher GMAT-V means than do foreign ESL candidates. However, they are quite different from the GMAT citizen ESL population, having substantially lower verbal, quantitative, and total scores.

- On balance, it is clear that differences between all foreign ESL and all foreign EPL candidates on GMAT total are due solely to differences in their performance on the verbal section of the GMAT--differences that favor candidates who report that they are most fluent in English.

Further perspective for assessing the level of performance of the foreign and citizen ESL candidates is provided below in the form of percentile ranks in the general candidate population (Educational Testing Service, 1980a) corresponding to the respective GMAT mean scores for the various groups.

Citizenship/ language group	Percentile ranks of mean GMAT scores for candidates taking GMAT			candidates who also took TOEFL		
	V	Q	Total	V	Q	Total
Foreign ESL	14	50	21	13	59	23
Foreign EPL	38	50	41	25	52	31
Citizen ESL	51	45	48	17	33	20

From the foregoing it is evident that U.S. citizen candidates, even those who indicate they are less fluent in English than in some other language, perform better on the verbal section of GMAT than self-reported foreign candidates, even those who report they are "most" fluent in English. It can also be inferred that citizen ESL candidates have verbal scores comparable to those of their citizen EPL counterparts but that

foreign candidates who report that they are less fluent in English than in some other language have markedly lower scores on the verbal test than their counterparts who indicate that they are most fluent in English.

It is also evident that the small group of citizen ESL candidates taking TOEFL in addition to GMAT is not representative of the larger GMAT citizen ESL population. However, insofar as performance on GMAT is concerned, the TOEFL/GMAT foreign EPL- and ESL-candidate subgroups appear to be comparable to the general GMAT foreign EPL and ESL populations.

GMAT Performance in Relation to Performance on TOEFL

Over 5,000 GMAT candidates were identified by cross-file matching as also having TOEFL test records during the study period. The TOEFL/GMAT sample includes both EPL candidates and ESL candidates.[3] EPL candidates in the TOEFL/GMAT subgroup have a lower GMAT verbal mean than that for all GMAT foreign EPL candidates, but a higher verbal mean than their ESL counterparts.

In this section, consideration is given (a) to the characteristics of the distribution of GMAT and TOEFL scores for foreign EPL and ESL candidates and (b) to the relationships between TOEFL and GMAT scores in these subgroups, with special emphasis on the relationship between TOEFL total and GMAT verbal.

Characteristics of score distributions. Table 4 shows the means and standard deviations of scores on TOEFL and GMAT for designated groups.[4] Also provided are percentile (centile) ranks of the respective means showing the standing of the typical TOEFL/GMAT foreign candidate (a) on TOEFL, relative to the score distribution for all prospective graduate-level applicants taking TOEFL between September 1978 and August 1980, and (b) on GMAT, relative to the score distribution for all candidates taking GMAT between October 1977 and July 1980. Several features of the data in Table 4 are noteworthy.

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[3] As noted at the outset, TOEFL's candidate population is made up almost exlusively of individuals whose reported "native language" is not English. However, it is apparent that for graduate-school bound candidates averaging somewhat over 25 years of age, the current "language of greatest fluency" may well be different from the historically relevant "native language" (e.g., that of the parental family and/or the larger society during an individual's early years).

[4] In the analyses involving TOEFL/GMAT candidates, data for candidates over 45 years of age and/or for whom the date of the undergraduate degree and the date of most recent testing differed by more than 15 years were excluded. This was done to avoid the possibility of unusual outlier effects in samples of foreign candidates. Certain analyses, replicated in the unrestricted samples, suggest that this precaution was not necessary.

Table 4

Means and Standard Deviations of Scores on TOEFL and GMAT and Centile Ranks of Mean Scores for TOEFL/GMAT-foreign Candidates

Test	Foreign EPL (N=1197)		Foreign ESL (N=3918)		EPL & ESL (N=5115)		Centile rank of mean**		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	EPL	ESL	EPL & ESL
GMAT Verbal	20.2	9.0	15.7	7.7	16.8	8.4	25	13	18
GMAT Quantitative	27.5	9.8	29.0	9.2	28.6	9.4	52	60	60
GMAT Total	418.0	113.3	389.8	97.5	396.4	103.4	31	23	26
TOEFL Total	589.4	61.3	541.8	71.7	552.9	66.4	89	71	77
TOEFL Listening	58.2	6.9	54.8	6.9	55.6	6.9	83	71	75
TOEFL Writing	58.7	7.0	53.0	7.2	54.3	7.1	88	68	72
TOEFL Reading	59.9	6.4	54.8	7.1	56.0	6.8	88	67	74

Note: In analyses involving the TOEFL/GMAT sample, candidates over 46 years of age and/or for whom the date of testing differed by more than 15 years from the date of the undergraduate degree were excluded. Thus, Ns in this table and others involving this sample are less than those reported in earlier tables.

*The percentile ranks for GMAT scores are relative to norms for all GMAT candidates tested between 10/77 and 7/80; those for TOEFL scores are for all graduate-level TOEFL candidates tested between 9/78 and 8/80. For GMAT, normative sample means are 26, 27, and 462 for V, Q and Total, respectively; standard deviations are 9, 8, and 105. For TOEFL, graduate-level means are 51.1, 49.4, 51.0, and 505 for Listening Comprehension, Structure and Written Expression, Reading Comprehension, and Total, respectively, and standard deviations are 6.8, 7.6, 7.5 and 65.

- The typical GMAT/TOEFL candidate was well above average in performance on TOEFL; the TOEFL total mean of 553 is at the 77th centile in the distribution of scores for TOEFL graduate-level candidates.[5]

- As expected, the typical EPL candidate performed better on TOEFL (with TOEFL total at the 89th centile) than the typical ESL candidate (at the 71st centile).

- EPL and ESL groups are separated somewhat more sharply by their TOEFL scores than by their GMAT verbal scores--e.g., in analyses not reported in detail, the point biserial correlation coefficient (computed as a measure of the degree of separation of the distributions of scores for EPL and ESL groups, respectively) for TOEFL total vs. EPL/ESL (1,0) was found to be .30, while the comparable coefficient for GMAT verbal vs. the EPL/ESL criterion was .23.

- The typical TOEFL/GMAT foreign candidate (though average or better on GMAT-Q) is well below the general candidate average on GMAT verbal--i.e., the GMAT-V mean of 16.8 is at approximately the 18th centile among all GMAT candidates. EPL candidates have somewhat higher average verbal scores (25th centile) than do ESL candidates (13th centile).

Measures of central tendency and variability alone are not sufficiently descriptive of the distributions of scores of TOEFL/GMAT foreign candidates on the verbal measures under consideration here, as may be seen in Figures 1 and 2. These figures show the relative frequency of scores (i.e., the percentage of candidates) in various intervals of the scales for GMAT verbal and quantitative (Figure 1) and TOEFL reading comprehension and total (Figure 2) for foreign ESL and foreign EPL candidates. In Figure 1, relative frequency polygons representing the distribution of scores of all GMAT candidates on GMAT-V and GMAT-Q are superimposed on the distributions for ESL candidates; in Figure 2, a similar comparison is shown for the TOEFL total distributions of all graduate-level TOEFL candidates and of TOEFL/GMAT foreign ESL candidates.[6]

- In Figure 1 it is evident that the distribution of GMAT verbal scores for ESL candidates is centered near the low end of the verbal score scale and tends to be positively skewed--i.e., characterized by heavy concentrations of scores in two or three of

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[5] The mean of 553 on TOEFL for these TOEFL/GMAT candidates is almost identical to the mean (556) for some 9,000 TOEFL candidates tested during the study period who indicated that they were taking TOEFL because they planned to enter a graduate school of management (see Wilson, 1982a).

[6] The distribution for all GMAT candidates is based on candidates tested during the 1975-76 testing year (available from unpublished material provided by the GMAT program); the TOEFL graduate-level distribution is derived from tables published in the TOEFL Test and Score Manual (1981).

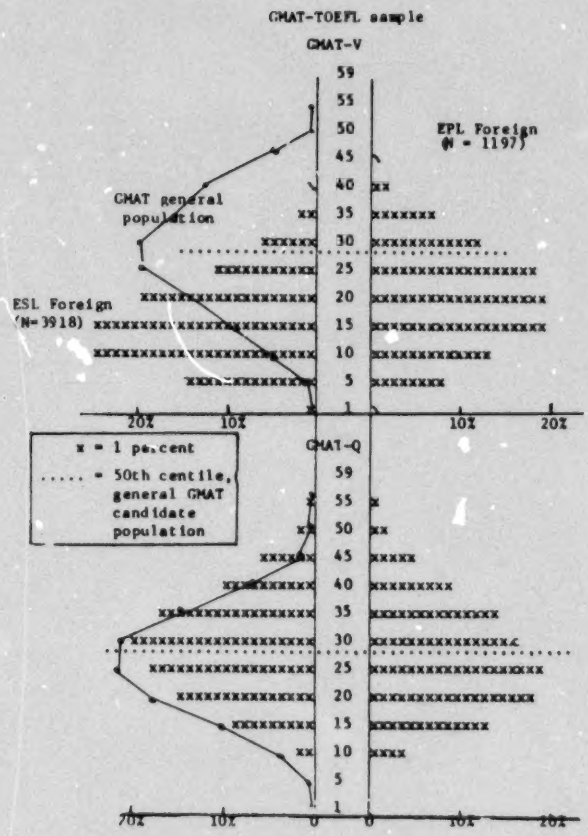

Figure 1. Relative frequency distributions of GMAT-V and GMAT-Q scores for foreign EPL and foreign ESL candidates

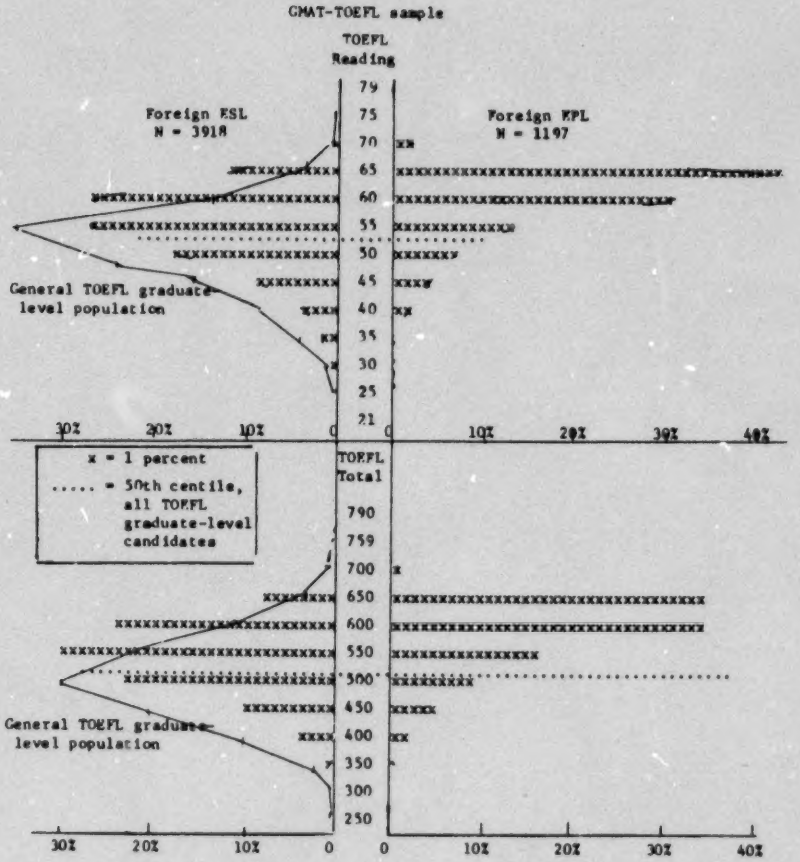

Figure 2. Relative frequency distributions of TOEFL Scores for TOEFL/GMAT-foreign EPL and ESL candidates

the lowest intervals with a gradual decline in frequencies over several higher intervals.[7] The GMAT-V score distribution for foreign EPL candidates is less inclined toward positive skewness, even though more than three-fourths of the distribution is below the all-candidate median.

Generally speaking, these properties are characteristic of distributions of scores on any standardized test that is of well above average difficulty for a given group. The distributions of TOEFL reading and total scores for these candidates, however, exhibit different properties.

- Figure 2 shows that the distributions for both ESL and EPL candidates tend to be concentrated heavily above the center of the score distribution and that they exhibit negative skewness--i.e., very high concentration in one or two higher intervals with a gradual spread of scores across several lower score intervals--a tendency that is particularly pronounced in the distributions for foreign EPL candidates.

These properties are characteristic of score distributions on any standardized test that is of less than average difficulty for a given group, and TOEFL clearly is of less than average difficulty for those TOEFL candidates who also take GMAT. The fact that the scores of GMAT/TOEFL candidates are concentrated heavily in the lower range of the GMAT verbal scale and in the upper range of the TOEFL scale is significant because such circumstances generally are conducive to diminished efficiency of measurement within the particular high- and/or low-scoring groups under consideration. Because GMAT/TOEFL candidates perform exceptionally well on TOEFL and very poorly on GMAT verbal, neither test is maximally reliable for this particular population. Thus, their relationships are to some extent attenuated by pure "measurement" considerations as well as by distortions attributable to the less than "normative" level of proficiency in English.

Score interrelationships for EPL and ESL candidates. Using data for essentially the same TOEFL/GMAT sample as that considered here, Powers (1980) examined the correlation between TOEFL and GMAT scores in analyses that did not take into account differences in reported English language status. The correlations reported by Powers are shown in Table 5. Table 6 shows results obtained in the present study when correlations between the two sets of test variables were computed separately for EPL

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[7] The extent of concentration of the scores of GMAT foreign candidates at the lowest range of the verbal scale is indicated by the fact that, among candidates tested during 1975-76, almost one-half (48.5 percent) of all candidates with GMAT verbal scores of 12 or below were noncitizens who, during that testing year, accounted for only 15.6 percent of the total candidate population, and that foreign candidates with scores of 12 or below represented some 28 percent of all foreign candidates tested during that year.

and ESL candidates--groups that differ in average level of developed proficiency in English, as reflected in TOEFL, and in average level of developed verbal reasoning ability, as reflected in GMAT verbal.

- Table 5 shows that, in the undifferentiated sample, the strongest relationship (r = .71) obtains between GMAT verbal and TOEFL total (a composite of measures of English language listening and reading comprehension and knowledge of essential points of English grammar and usage); GMAT quantitative and TOEFL variables are not closely related (e.g., for TOEFL total vs. GMAT-Q, r = .39). Due to the fact that GMAT total includes a "nonverbal" component, the GMAT total relationship with TOEFL total (r = .66) is lower than the TOEFL/GMAT verbal relationship.

From Table 6, it is evident that TOEFL/GMAT verbal correlations are consistently higher in the EPL sample than in either the combined EPL/ESL sample (Table 5) or the ESL sample.

- One reasonable hypothesis regarding such results is that the scores obtained on GMAT verbal are more reliable indicators of differences in verbal ability (less "contaminated" by differences in English proficiency, per se) for GMAT candidates in the range of "developed English proficiency" represented by the TOEFL score distribution of EPL candidates than for GMAT candidates exhibiting, on the average, a lower level of developed English proficiency (i.e., ESL candidates). It should be recalled in this connection that the distribution of verbal scores for ESL candidates had a proportionately heavier concentration of scores near the low end of the scale than did the distribution for EPL candidates.

Although not shown in the tables, the relationships between GMAT verbal and GMAT quantitative scores and between TOEFL total and GMAT quantitative scores are relevant.

- In samples of GMAT candidates generally, the correlation between GMAT verbal and GMAT quantitative is reported to be in the .55 - .57 range.[8] In the EPL sample, the verbal-quantitative correlation was .60 and in the ESL sample it was .50; in the combined sample, the verbal-quantitative correlation was essentially the same as that reported for the general candidate population; the correlation of TOEFL total with GMAT-Q (approximately .4 in EPL, ESL, and combined samples) was somewhat lower than the verbal-quantitative correlations. The fact that verbal-quantitative correlations in these foreign samples were like those in general GMAT candidate samples indicates that, despite the very depressed levels of GMAT verbal scores of foreign candidates, their verbal scores still have sufficient psychometric viability to exhibit a

[8]Unpublished internal data.

Table 5

Simple Correlation Between GMAT and TOEFL Scores:

TOEFL/GMAT-foreign Sample (EPL & ESL)

GMAT score	TOEFL score			
	Listening Comprehension	Structure and Written Expression	Reading Comprehension and Vocabulary	Total
GMAT-Verbal	.58	.66	.69	.71
GMAT-Quantitative	.29	.37	.39	.39
GMAT-Total	.52	.61	.64	.66

Note: Combined EPL and ESL correlations as reported by Powers (1980); N = 5,781

Table 6

Simple Correlation between GMAT and TOEFL Scores:

EPL and ESL Subgroups, TOEFL/GMAT

GMAT score		TOEFL score			
		Listening Comprehension	Structure and Written Expression	Reading Comprehension and Vocabulary	Total
GMAT-Verbal	(EPL)	.63	.70	.73	.76
	(ESL)	.53	.61	.66	.68
GMAT-Quantitative	(EPL)	.37	.35	.39	.41
	(ESL)	.27	.42	.43	.42
GMAT-Total	(EPL)	.58	.61	.65	.68
	(ESL)	.47	.60	.63	.64

Note: Ns for subgroups are 1197 and 3918, EPL and ESL, respectively.

"normal" relationship with scores earned on the GMAT quantitative section.

TOEFL total and GMAT verbal: A detailed analysis.[9] Graphic portrayals of the TOEFL total/GMAT verbal relationship in EPL and ESL subgroups are is provided in Figures 3 and 4. Figure 3 is a cross-tabulation of scores on the two measures in the EPL sample; Figure 4 is a comparable cross-tabulation for the ESL sample. In each figure, a line has been drawn that connects the median GMAT-V scores for candidates in the various TOEFL score intervals.[10]

- The somewhat closer association between TOEFL and GMAT-V in the EPL than in the ESL sample is evident in the data. It is also clear (a) that the relationship between the two sets of measures is not linear throughout the entire range of scores and (b) that tendencies toward nonlinearity are somewhat more pronounced in the ESL sample (in which 38 percent of candidates scored below 13 on GMAT verbal) than in the EPL sample (in which only 22 percent of the sample was concentrated in the lowest GMAT-V score intervals).

A systematic assessment of the relationships portrayed in these scatterplots is provided in Table 7, which shows the mean level of the observed GMAT verbal scores for candidates in selected TOEFL score intervals. Also shown in the table are two sets of predicted GMAT means estimated using TOEFL total as the predictor variable. One set of estimates is based on a regression equation derived under the assumption of a linear relationship throughout the range of scores; the other is based on an equation that takes into account the observed curvilinearity, which provides a "quadratic fit" for the data.[11] In both instances, equations were developed using data for the combined EPL and ESL samples. The actual GMAT verbal means were determined directly from the data shown in Figures 3 and 4.

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[9]For detailed analyses of the nature of the relationship between each of the TOEFL section scores and GMAT scores in the total GMAT/TOEFL sample, see Powers (1980).

[10]The computer program employed used TOEFL total intervals defined as follows: e.g., 200.0001 - 225.0000, 225.0001 - 275.0000. In printing out, the decimals were dropped. Thus, one score point should be added to the lower limit of each interval to indicate the actual range included. For example, 425-475 includes scores of 426-475, inclusive.

[11]In the curvilinear equation, the actual TOEFL total score and the square of the score are entered as predictors. This procedure "exaggerates" the contribution of scores in the higher range relative to scores in the lower range. The curvilinear estimates are as reported by Powers (1980, Table 4), based on quadratic equations using data for all TOEFL/GMAT foreign candidates, EPL and ESL combined.

SCATTERPLOTS OF VARIOUS SCORES FROM GMAT-TOEFL MATCHED FILE
-BY CITIZEN/LANGUAGE GROUPS--RESTRICTED BY AGE, YEARS OUT

FLUENT NON-CITIZENS

Foreign, English primary language (EPL)

r = .759

GMAT VERBAL	TOEFL TOTAL 200-225	225-275	275-325	325-375	375-425	425-475	475-525	525-575	575-625	625-675	675-725	725-775	775-800	TOT.
58 - 60														0
53 - 57														0
48 - 52														0
43 - 47										4	2			6
38 - 42									1	25	3			29
33 - 37									15	68	3			86
28 - 32								3	28	107	2			140
23 - 27						1	1	12	79	117	3			213
18 - 22							4	38	127	65				234
13 - 17						6	30	63	113	15				227
8 - 12					3	17	38	58	39	2				157
3 - 7				2	16	35	27	11	7					98
0 - 2						2	4	1						7
TOTAL	0	0	0	2	19	61	104	186	409	403	13	0	0	1197

GROUP	N	MIN	MAX	MEAN	SD N	SD N-1
TOEFL TOTAL	1197	353.0000	697.0000	589.3567	61.2716	61.2972
GMAT VERBAL	1197	1.0000	46.0000	20.2389	9.0252	9.0290
R= 0.7589						

Figure 3. Scatterplot of scores on GMAT-V and TOEFL Total: Foreign EPL Candidates

SCATTERPLOTS OF VARIOUS SCORES FROM GMAT-TOEFL MATCHED FILE
-BY CITIZEN/LANGUAGE GROUPS--RESTRICTED BY AGE, YEARS OUT

NON-FLUENT NON-CITIZENS

Foreign, English secondary language (ESL)

r = .681

GMAT VERBAL	TOEFL TOTAL 200-225	225-275	275-325	325-375	375-425	425-475	475-525	525-575	575-625	625-675	675-725	725-775	775-800	TOT.
58 - 60														0
53 - 57														0
48 - 52														0
43 - 47									1	3				4
38 - 42					1		1		1	17				20
33 - 37					1	1	1	2	21	38	1			65
28 - 32				1	1	4	5	20	95	95	3			224
23 - 27				1	7	2	6	78	224	97				415
18 - 22				1	4	12	81	270	310	60				738
13 - 17				2	12	44	230	446	197	16				947
8 - 12			1	8	47	144	360	306	67	4				937
3 - 7			1	11	70	167	203	68	9					529
0 - 2				2	10	13	13		1					39
TOTAL	0	0	2	26	153	387	900	1190	926	330	4	0	0	3918

GROUP	N	MIN	MAX	MEAN	SD N	SD N-1
TOEFL TOTAL	3918	297.0000	693.0000	541.8167	61.7452	61.7531
GMAT VERBAL	3918	1.0000	44.0000	15.6753	7.7344	7.7356
R= 0.6809						

Figure 4. Scatterplot of scores on GMAT-V and TOEFL Total: Foreign ESL Candidates

Table 7

Level of Observed GMAT-Verbal Scores in Relation to Level

Expected from TOEFL Total Score: EPL and ESL Subgroups

TOEFL interval	Mid-point	Estimated GMAT-V*		Observed GMAT-V mean for candidates in TOEFL interval					
		Linear	Curvi-linear	EPL		ESL		Combined	
626-675	650	25.6	28.5	28.1	(416)**	27.0	(334)	27.6	(750)
576-615	600	21.1	20.8	19.7	(409)	20.7	(926)	20.4	(1335)
526-575	550	16.5	14.9	14.7	(186)	15.2	(1190)	15.1	(1376))
476-525	500	12.1	10.8	10.3	(104)	11.2	(900)	11.1	(1004)
426-475	450	7.6	8.5	7.6	(61)	8.8	(387)	8.6	(448)
376-425	400	3.0	n.a.	5.8	(19)	9.0	(153)	8.6	(172)

*Linear estimates are based on a regression equation based on data for the combined sample, for predicting GMAT-V from TOEFL Total: Predicted V = .0902 (Total) - 33.07. Curvilinear estimates are as reported by Powers (1980), using a total-sample equation which included Total-squared to yield the best quadratic fit.

**Number in parentheses is the number of candidates in the respective TOEFL Total intervals.

- o Generally speaking, estimates based on the quadratic equation are closer to the observed means in both the EPL and the ESL groups than are the estimates assuming linearity.

- o Trends in the fit between estimated and observed means are quite similar for both EPL and ESL groups when estimates are based on TOEFL scores above the 426-475 interval; in the lower intervals, the linear estimates fit the observed GMAT-V means of EPL candidates more closely than those of ESL candidates.

The general similarity of trends in the two samples suggests that, for purposes of predicting GMAT verbal from TOEFL total, separate treatment of EPL and ESL subgroups probably is not necessary.

- o If the mean TOEFL total scores for EPL and ESL groups (as shown in Table 4) are substituted in the total sample regression equation (reported in the note to Table 7), it will be found that the estimated and observed GMAT verbal means are essentially identical. Consistent with this, in other analyses not shown in the table, when English-language vs. non-English language dominance was used as a nominal predictor variable (EPL = 1, ESL = 0) in combination with TOEFL total to predict GMAT verbal, the resulting multiple correlation coefficient did not differ from that for TOEFL total alone.

Summary of GMAT and TOEFL/GMAT Findings

The GMAT and TOEFL/GMAT analyses that have been reviewed indicate the following.

- o Insofar as performance on GMAT quantitative is concerned, GMAT foreign and TOEFL/GMAT candidates cannot be distinguished from the general GMAT candidate population. Moreover, on GMAT-Q, groups differing in average level of English language proficiency--i.e., ESL foreign, EPL foreign, and "GMAT candidates generally" (the last representing the range of English-language proficiency characteristic of management-school bound, English-speaking U.S. citizens)--perform equally well, on the average, and their overall GMAT-Q score distributions are quite comparable.

- o However, with respect to GMAT verbal, for all foreign candidates taking GMAT and within the subgroup also taking TOEFL, the average performance of both ESL and EPL candidates is lower than that of the GMAT candidate population generally; the average performance of ESL candidates, reportedly less fluent in English than in another language, is markedly lower; however, as TOEFL scores approach 600, the mean GMAT verbal score of TOEFL/GMAT candidates approaches that of the GMAT general population.

- o Differences in the average GMAT-V scores for EPL and ESL candidates in the TOEFL/GMAT sample are consistent with differences in

their average performance on TOEFL total; and scores on this measure are substantially correlated with GMAT verbal (r = .71 in the total sample, r = .76 in the EPL sample, r = .68 in the ESL sample).

- The higher TOEFL/GMAT correlations in the EPL sample may be due to the possibility that, because of their greater average level of English proficiency, the EPL candidates' performance on GMAT was more reliably assessed than that of their ESL counterparts, who had lower average English language facility.

- Generally speaking, interpretation of observed relationships between two tests, one of which is of well above average difficulty (GMAT-V) and the other of below average difficulty (TOEFL) for the sample under consideration, is complicated by purely psychometric considerations unrelated to the "skills" the tests are designed to measure. GMAT candidates who also take TOEFL are typically at or above the 75th centile among graduate-level TOEFL candidates (EPL candidates typically scored near the 90th centile) but below the 25th centile on GMAT verbal. Theoretically, for highly selected groups of TOEFL candidates (like those taking GMAT), the correlation between scores on a somewhat more difficult version of TOEFL and a somewhat less difficult version of GMAT verbal should provide better estimates of the level of relationship between the skills being measured than those reported here.

On balance, the findings that have been reviewed suggest strongly that the lower level of English language proficiency is a major factor contributing to the depressed score levels of foreign candidates, especially ESL candidates, on GMAT verbal relative to the level for GMAT candidates generally. Despite the depressed levels of verbal scores for foreign candidates, however, it is evident that these scores have significant psychometric viability--e.g., they correlate substantially with TOEFL scores, and verbal-quantitative correlations are consistent with those observed in the general GMAT candidate population.

Section 3. GRE Foreign and TOEFL/GRE Candidates: Selected Characteristics and Score Profiles

The analyses in this section are based on foreign candidates taking the GRE Aptitude Test during the 1977-78 testing year and a subgroup of these candidates who also took TOEFL during the period from September 1977 through August 1979. Table 8 provides information regarding selected demographic and academic characteristics of the samples under consideration. Data from the general GRE candidate population for the 1978-79 testing year (Wild, 1980) are provided for purposes of comparison.[12] All data are from the GRE files. Since the number of TOEFL/GRE citizen ESL candidates was limited, data for citizen ESL candidates were not included in the TOEFL/GRE analyses.

- Judging from the data in Table 8, the GRE foreign candidate population as compared to the general GRE population was slightly older on the average and characterized by higher percentages of males, doctorate-degree seekers, candidates with some previous graduate study, and candidates planning to major in physical or biological sciences. In the TOEFL/GRE subgroups, very high proportions of males were oriented toward physical and bioscience departments. As in the general candidate population, females were underrepresented among foreign candidates planning study in the biological and physical sciences and overrepresented among those oriented to humanities and social sciences.

GRE Performance

Measures of central tendency and variability (means and standard deviations) of scores on the GRE Aptitude Test for GRE foreign EPL and ESL candidates, GRE citizen ESL candidates, and EPL and ESL subgroups taking TOEFL are shown in Table 9. Also shown are data for the GRE general candidate population. In evaluating these data it is important to keep in mind that the several groups differ, as is shown in Table 8, with respect to sex composition and relative concentration in graduate fields of study that differ in verbal and quantitative emphasis.

- Foreign ESL candidates (who indicated that they communicated better in a language other than English) generally, and that subgroup of GRE foreign ESL candidates who also took TOEFL, clearly had depressed GRE verbal means (more than 1.0 standard deviation below the general population mean).

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[12] Strictly comparable data were not available for the general candidate population tested during 1977-78. For the purpose of comparison with foreign and citizen ESL groups, the 1978-79 "all candidates" data are deemed to be appropriate, ambiguities regarding coding for intended major field notwithstanding (see note, page 3).

Table 8

Selected Characteristics of GRE and TOEFL/GRE Candidates (Foreign EPL, Foreign ESL, and Citizen-ESL): Data for 1977-78 Except as Noted

Characteristic	GRE (including TOEFL/GRE)			TOEFL/GRE only		GRE general candidate population (1978-79)
	Foreign		U.S. citizen	Foreign		
	EPL*	ESL	ESL	EPL	ESL	
Mean age	26.2	26.5	27.2	24.9	25.9	25.9
Mean year of BA/BS	75.1	74.9	74.5	75.4	74.8	(75.0)†
Male (%)	64	74	50	78	76	47
Undergraduate school public (%)	74	72	68	76	75	64
No previous graduate study (%)	68	59	69	60	60	78
Doctorate-degree goal						
Males	51	46	50	48	46	44
Females	40	35	37	41	34	30
Intended field (Males)						
Humanities (%)	8	6	13	3	5	13
Social Sciences (%)	31	25	43	14	21	39
Biosciences (%)	14	11	16	10	9	18
Physical Sciences (%)	38	49	21	67	58	19
Other (%)	9	9	7	7	7	11
Intended field (Females)						
Humanities (%)	13	25	15	11	20	11
Social Sciences (%)	48	38	50	40	38	50
Biosciences (%)	21	19	21	22	16	21
Physical Sciences (%)	7	16	5	19	16	4
Other (%)	11	3	10	8	10	13
Number of cases	11,114	11,172	3,093	1,369	2,451	218,682

NOTE: Data for the GRE general candidate population are for the 1978-79 testing year since comparable data for the 1977-78 year were not available.

*EPL indicates English is primary language and ESL indicates English is secondary language according to candidates' replies to GRE background question; citizenship status is also based on responses to the relevant GRE background question. Data for a small number of citizen ESL candidates in the TOEFL/GRE sample are not reported.

†This mean has been reduced by one year to allow for the year's difference between the 1978-79 and 1977-78 samples.

Table 9

Means and Standard Deviations of GRE Aptitude Test Scores for All GRE-foreign and GRE-Citizen ESL Candidates, and for Subgroups Taking TOEFL

Group		GRE-Verbal		GRE-Quantitative		GRE-Analytical	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
GRE, general*	831,650	479	129	518	135	496	120
Foreign EPL	11,114	435	141	543	144	438	139
Foreign ESL	11,172	342	95	574	145	383	114
Citizen ESL	3,093	430	127	460	140	422	133
TOEFL/GRE							
Foreign-EPL	1,369	386	123	603	133	406	119
Foreign ESL	2,451	345	95	606	136	400	114
Combined	3,820	360	108	605	135	402	116

*From 1980-81 Guide to the Use of Graduate Record Examinations (ETS)--examinees tested between 10/77 and 6/80.

- Foreign EPL candidates (who indicated that they communicated better in English than in any other language) generally were somewhat below average on the verbal and the analytical measures.

- Those GRE foreign EPL candidates who also took TOEFL (about one-sixth of all foreign EPL candidates) had substantially lower means on the verbal measure than did foreign EPL candidates generally. At the same time, TOEFL/GRE EPL candidates performed somewhat better on the verbal measure than did their TOEFL/GRE ESL counterparts. (Selection into the TOEFL candidate pool for the foreign EPL GRE candidate is associated with lower performance on the verbal measure.)

- Foreign candidates, without regard to intended field of study, had higher quantitative means than the general candidate population, but substantially lower means on the analytical ability measure; it is noteworthy that the foreign ESL candidates generally, and both ESL and EPL candidates in the TOEFL/GRE subgroup, performed exceptionally well on the quantitative test.

Additional perspective for assessing the level of performance of the foreign and citizen ESL candidates is provided below in the form of percentile ranks in the general candidate population (Educational Testing Service, 1980b) corresponding to the respective means.

Citizenship/ language group	Percentile ranks of mean GRE scores for candidates taking GRE			candidates who also took TOEFL		
	V	Q	A	V	Q	A
Foreign EPL	31	56	31	23	72	18
Foreign ESL	15	64	14	16	72	17
Citizen ESL	36	33	20	n.a.	n.a.	n.a.

From the foregoing it is evident that foreign ESL candidates generally, despite exhibiting a high level of developed ability to perform tasks of the type represented by items in the quantitative test, do not perform well on either the verbal test or the analytical test (whose items make a relatively heavy demand on English-language verbal skills).

Performance by intended field of study. As noted above, foreign candidates--especially foreign ESL candidates--have higher GRE-Q means than do GRE candidates generally. However, they more frequently intend to study in engineering, mathematics, and physical science fields (see Table 8), and candidates in these fields tend to have higher than average quantitative scores. Figure 5 shows profiles of means on the verbal, quantitative, and analytical measures for GRE foreign and TOEFL/ GRE foreign EPL and ESL candidates classified according to ten broad

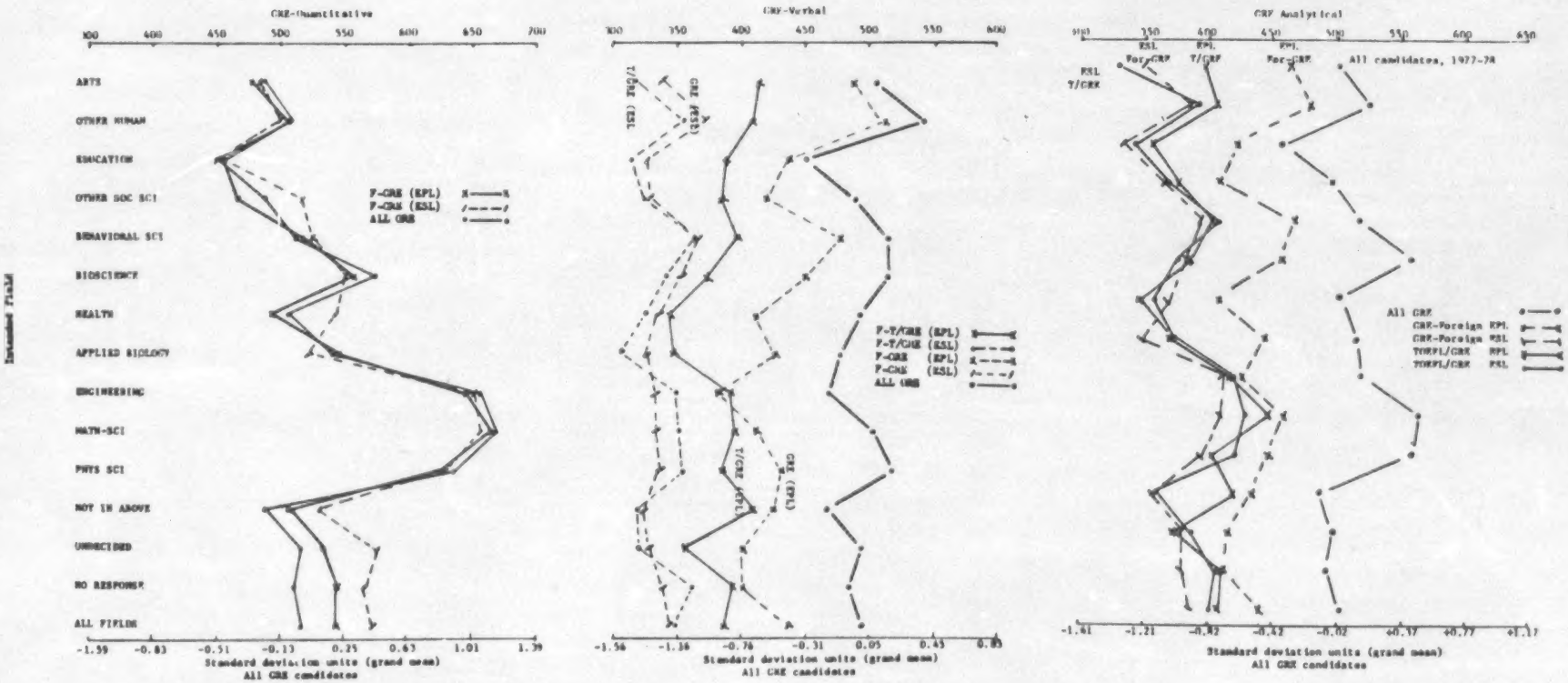

Figure 5. Profiles of GRE-Q, GRE-V, and GRE-A means for groups of foreign GRE candidates and/or TOEFL/GRE foreign candidates reporting English as the primary language (EPL) or as the secondary language (ESL), and for all GRE (ALL GRE) candidates without regard to language or U.S. citizenship status, by intended graduate field of study

intended-field categories.[13] In assessing the differences in profiles for various groups, it is important to keep in mind that TOEFL/GRE candidates constitute a subgroup of GRE foreign candidates.

The contrast in the level of performance of foreign candidates on the quantitative measure as opposed to the verbal and analytical measures is strikingly demonstrated in the figure.

- On the quantitative test, the profiles of means by intended area of study for foreign EPL and ESL candidates conform very closely in level and pattern to the profile for all GRE candidates; no noticeable quantitative-score mean differences are associated with reported differences in reported English-language primacy when control is introduced for intended field.

- On both the verbal and the analytical tests, the pattern of means of foreign candidates by intended area is generally similar to the pattern of field means in the general candidate population, but the profiles differ rather markedly in level.

- On both the verbal and the analytical measures, foreign EPL candidates are seen to exhibit generally higher performance across all fields than foreign ESL candidates generally.

- Relative to their ESL counterparts, foreign EPL candidates who also took TOEFL performed somewhat better on the verbal than on the analytical test. Note that the verbal profile for TOEFL/GRE EPL candidates is clearly separated in level from the profiles of GRE ESL and TOEFL/GRE ESL candidates, whereas the analytical profiles are not clearly distinguishable.

Citizen ESL candidates, whose profiles are not shown (see Appendix A for means by field), had higher verbal and analytical means in all intended fields than did foreign ESL candidates and lower quantitative means for all fields than did either foreign EPL or foreign ESL candidates.

On balance, the GRE performance data that have been reviewed indicate that foreign candidates who report communicating better in English than in another language (EPL candidates) perform better on both the verbal and the analytical measures than do foreign candidates who report the communicate better in some other language (ESL candidates). The data also show that average performance on GRE quantitative does not vary across

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[13] Appendix A shows the fields included in each category shown in the figure. Also included in Appendix A are tabular summaries for each of the groups under consideration (i.e., GRE foreign EPL, foreign ESL, and citizen ESL candidates, and TOEFL/GRE foreign EPL and ESL candidates), showing for each intended area of study and for each test (a) the number of candidates and (b) the mean and standard deviation of scores.

groups differing, by inference, in average level of developed English language proficiency when control is introduced for intended field of study.

GRE Performance in Relation to Performance on TOEFL

Almost 4,000 GRE candidates also took TOEFL during the study period; the sample includes both EPL and ESL candidates. Foreign EPL candidates taking the GRE who are selected into TOEFL candidacy (because they need to demonstrate their proficiency in English as well as their performance on GRE tests) have been seen to have substantially lower verbal means but considerably higher quantitative means than foreign GRE EPL candidates who do not take TOEFL, but somewhat higher verbal means than their ESL counterparts in the TOEFL/GRE sample.

In this section, consideration is given to (a) the characteristics of the distributions of TOEFL and GRE Aptitude scores for TOEFL/GRE foreign ESL and EPL candidates and (b) the relationships between TOEFL and GRE Aptitude test scores in these subgroups.

Characteristics of score distributions. Table 10 shows the means and standard deviations of scores of TOEFL/GRE EPL and ESL candidates on the three TOEFL sections (listening comprehension, structure and written expression, and reading comprehension and vocabulary) and TOEFL total, and centile ranks of the means relative to the population of graduate-level candidates who took TOEFL between October 1977 and August 1980; GRE data are also provided in the table (percentiles indicate relative standing in the general candidate population for the period October 1977-June 1980).

- The typical GRE/TOEFL examinee was well above average in performance on TOEFL; the TOEFL total mean of 559 for the combined ESL-EPL sample is at approximately the 80th centile for TOEFL candidates planning to enter graduate-level degree programs.[14]

- As expected, the typical EPL candidate performed better on TOEFL (mean at 84th centile) than did the typical ESL candidate (mean at 76th centile).

- EPL and ESL subgroups are separated to about the same extent by TOEFL total as by GRE verbal; the point biserial coefficient (computed as a measure of the degree of separation of EPL and

[14]The 559 TOEFL total mean for these TOEFL/GRE candidates is somewhat higher than the mean (534) for some 36,000 TOEFL candidates tested during 1977-1979 who indicated that they were taking TOEFL because they planned to enter graduate department as degree-seeking students. Means by broad area of intended department were 536, 533, 526, and 536 for humanities, social sciences, biosciences and physical sciences, respectively (see Wilson, 1982a).

Table 10

Means and Standard Deviations of TOEFL and GRE Scores and Centile Ranks of Mean Scores for TOEFL/GRE Candidates

Test	Foreign EPL N = 1366		Foreign ESL N = 2442		Combined N = 3808		Centile ranks of means*		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	EPL	ESL	Combined
GRE-V	386	123	345	95	360	108	23	16	18
GRE-Q	603	133	606	136	605	135	72	72	72
GRE-A	406	119	400	114	402	116	24	23	23
TOEFL									
Total	573	64	552	61	559	63	84	76	80
Listening	56	7	55	7	55	7	76	72	72
Writing	57	7	54	7	55	7	83	72	76
Reading	59	7	56	7	57	7	84	74	78

*Centile ranks of GRE means are relative to norms for general candidate population for the period 10/77 - 6/80; for TOEFL means centiles are relative to graduate-level candidates tested between 9/78 and 8/80.

ESL subgroups) for TOEFL total vs. EPL/ESL (coded 1,0) is .16, while that for GRE verbal vs. EPL/ESL is .18. However, they are essentially undifferentiated by performance on GRE quantitative and GRE analytical.

Figures 6 and 7 point up characteristics of the distributions of TOEFL/GRE candidates' scores on the three GRE Aptitude measures and TOEFL total.

- Figure 6 shows that the distribution of GRE verbal scores for the TOEFL/GRE sample (EPL and ESL combined) is concentrated near the low end of the GRE scale and is positively skewed--i.e., within the verbal distribution, the proportion of relatively low scores is much higher than the proportion of relatively high scores; this is true to only a slightly lesser extent for the analytical distribution. On the other hand, the quantitative distribution is centered above the general candidate median and tends to be negatively skewed.

- The TOEFL total distributions for EPL and ESL subgroups in Figure 7 show characteristics opposite to those of the GRE verbal and analytical score distributions in Figure 6. Reflecting the fact that on TOEFL total the means for EPL and ESL candidates, respectively, are at the 76th and 80th centiles relative to all graduate-level candidates, these distributions are concentrated largely above the mid-range of the TOEFL scale and tend to be negatively skewed.

Within a group for which given tests are either substantially above or below average in difficulty, efficiency of measurement (i.e., the reliability of observed differences between group members) tends to be attenuated. Accordingly, neither TOEFL nor GRE verbal nor GRE analytical is maximally "efficient" in TOEFL/GRE foreign samples, a factor that should be taken into account in assessing the level and nature of relationships between TOEFL and GRE Aptitude scores in the sample of foreign candidates taking both tests (see Figures 1 and 2 and related discussion of similar findings in the TOEFL/GMAT sample).

TOEFL/GRE score interrelationships. Tables 11 and 12 summarize results of general analyses of the relationship of TOEFL scores to GRE Aptitude scores. Table 11 shows simple correlations of the respective TOEFL section and total scores with GRE variables; Table 12 shows results of multiple regression analyses designed to assess (a) the relative contribution of the respective TOEFL section scores to prediction of the GRE variables and (b) differences in relationships under assumptions of linearity and curvilinearity. Results are shown separately for the EPL, ESL, and combined EPL/ESL samples.

- In Table 11 it may be seen that relationships between TOEFL scores and GRE verbal are systematically higher than TOEFL/GRE analytical relationships; TOEFL correlations with each of these

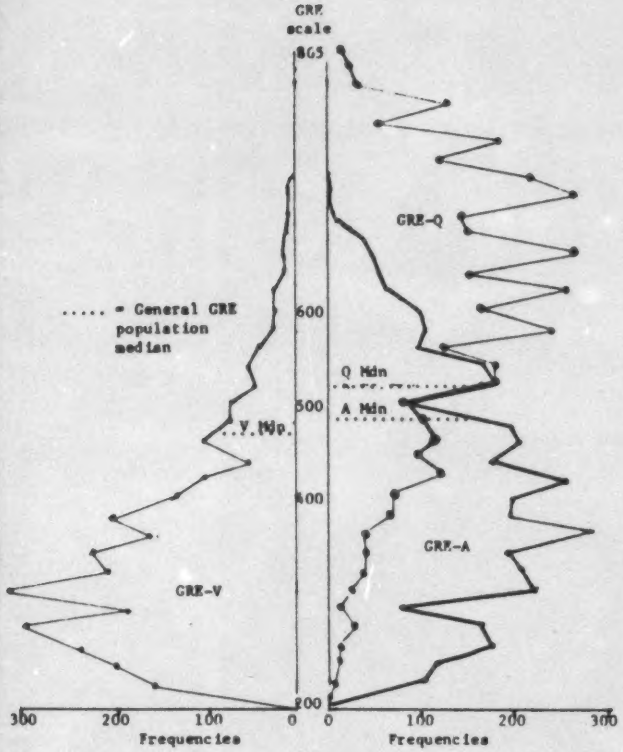

Figure 6. Frequency polygons representing the distributions of verbal, quantitative, and analytical ability scores of GRE-foreign candidates who also took TOEFL

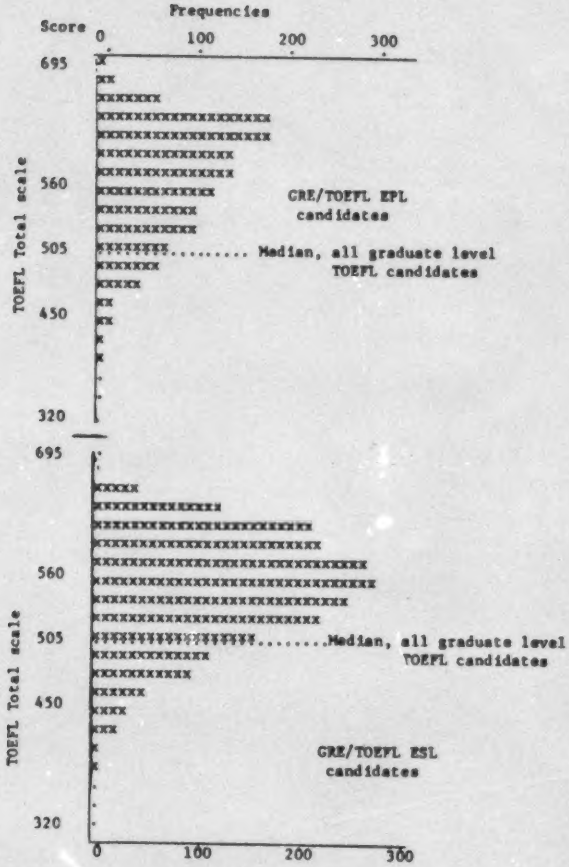

Figure 7. Frequency polygons representing the distributions of TOEFL Total scores of GRE-foreign EPL and ESL candidates who were also in the TOEFL candidate pool

Table 11

Simple Correlation between Scores on TOEFL and Scores on the GRE Aptitude Test for EPL, ESL, and Combined Samples

	GRE-Verbal			GRE-Quantitative			GRE-Analytical		
	EPL	ESL	Comb	EPL	ESL	Comb	EPL	ESL	Comb
Total	.74	.66	.70	.21	.21	.21	.64	.61	.62
Listening	.60	.48	.52	.14	.08	.10	.53	.47	.49
Writing	.69	.56	.63	.20	.22	.21	.58	.52	.53
Reading	.72	.67	.70	.23	.25	.24	.61	.58	.59

Table 12

Relative Contribution of TOEFL Part Scores to Prediction of GRE Aptitude Scores in Samples Differing in Reported English-language Communication Skill

Sample/Dependent Variable	beta weights*			Multiple Correlation (R)	TOEFL Total (r)	Quadratic (R)	TOEFL Reading (r)
	Listening	Writing	Reading				
Foreign ESL N = 2,442							
GRE-V	10	13	52	687	658	700	672
GRE-Q	-14	09	19	259	215	242	255
GRE-A	16	15	38	611	608	622	564
Foreign EPL N = 1,366							
GRE-V	17	25	40	750	745	788	717
GRE-Q	-04	05	22	233	212	216	230
GRE-A	19	18	34	640	639	658	609
Foreign ESL + EPL N = 3,808							
GRE-V	11	20	48	718	701	749	695
GRE-Q	-09	09	22	251	209	228	238
GRE-A	18	14	37	617	616	630	586

Note: Data are for foreign candidates taking TOEFL during 1977-79 who took GRE during 1977-78.

*These are standard partial regression weights. Decimals have been omitted for the weights and correlation coefficients in the table.

variables are systematically higher in the EPL than in the ESL sample.

- In the combined sample, coefficients for TOEFL total and reading comprehension vs. GRE verbal are equal (r = .70); in the ESL sample the coefficient for reading is slightly higher (.67 as compared to .66), and in the EPL sample the reverse is true (.74 and .72 for total and reading, respectively, vs. verbal).

- TOEFL scores are only weakly associated with GRE quantitative scores, and the level of the relationship is essentially constant across EPL and ESL groups.

Table 12 shows, for each sample, (a) the multiple correlation resulting from treating the three TOEFL section scores as a battery of predictors (rather than using TOEFL total) and the relative weighting of the respective TOEFL scores in analyses assuming linearity of the relationship between Aptitude scores and TOEFL scores, and (b) results obtained under an assumption of curvilinearity (i.e., when TOEFL total and TOEFL total squared were treated as predictors).

- In the combined samples (foreign ESL and EPL), for example, it may be seen that when GRE-V is the dependent variable, the multiple correlation of the three TOEFL section scores is .718 (as compared to the simple correlation of .701 between TOEFL total and GRE verbal); the largest standard regression weight was for reading (.48 as compared to .20 for writing and .11 for listening). When TOEFL squared is introduced, the TOEFL total/GRE verbal relationship (quadratic R) increases to .749, from R = .718 under the assumption of linearity, indicating some departure from linearity of the relationship.

- The data in Table 12, generally, suggest that there is little to be gained from treating TOEFL section scores as independent variables, rather than using TOEFL total, for the purpose of estimating the relationship between TOEFL scores and GRE Aptitude scores; however, they do point up the dominant role of reading comprehension among the section scores. The results also indicate that some improvement in estimation of GRE performance from TOEFL performance should be obtained using equations that include the squared TOEFL score element.

Data on the relationships among the respective GRE Aptitude measures in samples that differ in average level of proficiency in English are shown below.

Sample	Relationship		
	V,Q	V,A	Q,A
National (ETS, 1981)	.51	.72	.69
TOEFL/GRE EPL	.31	.75	.56
TOEFL/GRE ESL	.24	.68	.56
Combined	.26	.70	.56

- The correlation of GRE verbal with GRE quantitative (V,Q) is substantially lower in the TOEFL/GRE foreign sample than in a national sample of GRE candidates, as is the GRE-Q/GRE-A correlation (Q,A). The verbal/analytical (V,A) correlation, however, is relatively stable across samples differing in English language proficiency.

TOEFL total and GRE verbal: a more detailed examination. Figure 8 is a cross-tabular presentation of the relationship between TOEFL total and GRE verbal scores in the TOEFL/GRE foreign sample. In Figure 8, the dashed line connects points representing the mean GRE verbal score for candidates in various intervals on TOEFL; the solid line connects points representing the median scores for the respective TOEFL intervals. Note that the intervals containing the means of the respective reference groups have been marked by "***" and those containing the sample means on the two tests by "**." Several features of the data are noteworthy.

- As shown in Figures 7 and 8, the (marginal) distribution of GRE verbal is positively skewed, with a marked concentration of scores below the sample mean (the "**" interval), while that for TOEFL total tends to be negatively skewed (note concentration above the 550-570 interval with a scattering of lower scores).

- It may be determined from Figure 8 (a) that only about 14 percent of the foreign candidates have GRE verbal scores in or above the GRE reference group mean interval and (b) that 85 percent of these candidates scored in or above the TOEFL reference group mean interval--indicating, of course, that for TOEFL/GRE candidates TOEFL is of considerably less than average difficulty while GRE verbal is of considerably greater than average difficulty.

The curvilinear nature of the relationship between the two tests is evident from the trend lines connecting the means and medians of GRE verbal scores for individuals in the various TOEFL intervals. Note that the trend line of GRE-V means is consistently above that for the medians, indicating that the positive skewness observed in the marginal distribution tends to characterize GRE distributions in the respective TOEFL intervals.

- The distributions of GRE scores for candidates in the higher TOEFL intervals have considerable symmetry, whereas GRE distributions for individuals in the lower intervals of TOEFL tend to "pile up" in the lowest intervals of the GRE scale. These trends reflect the fact that the GRE verbal performance of foreign candidates with higher TOEFL scores (e.g., 600 or above) is comparable to that of GRE candidates generally, whereas for foreign candidates with lower scores on TOEFL, level of GRE verbal performance is depressed and the range is arbitrarily restricted because the GRE verbal scale does not permit downward assessment of differences among very low-scoring candidates.

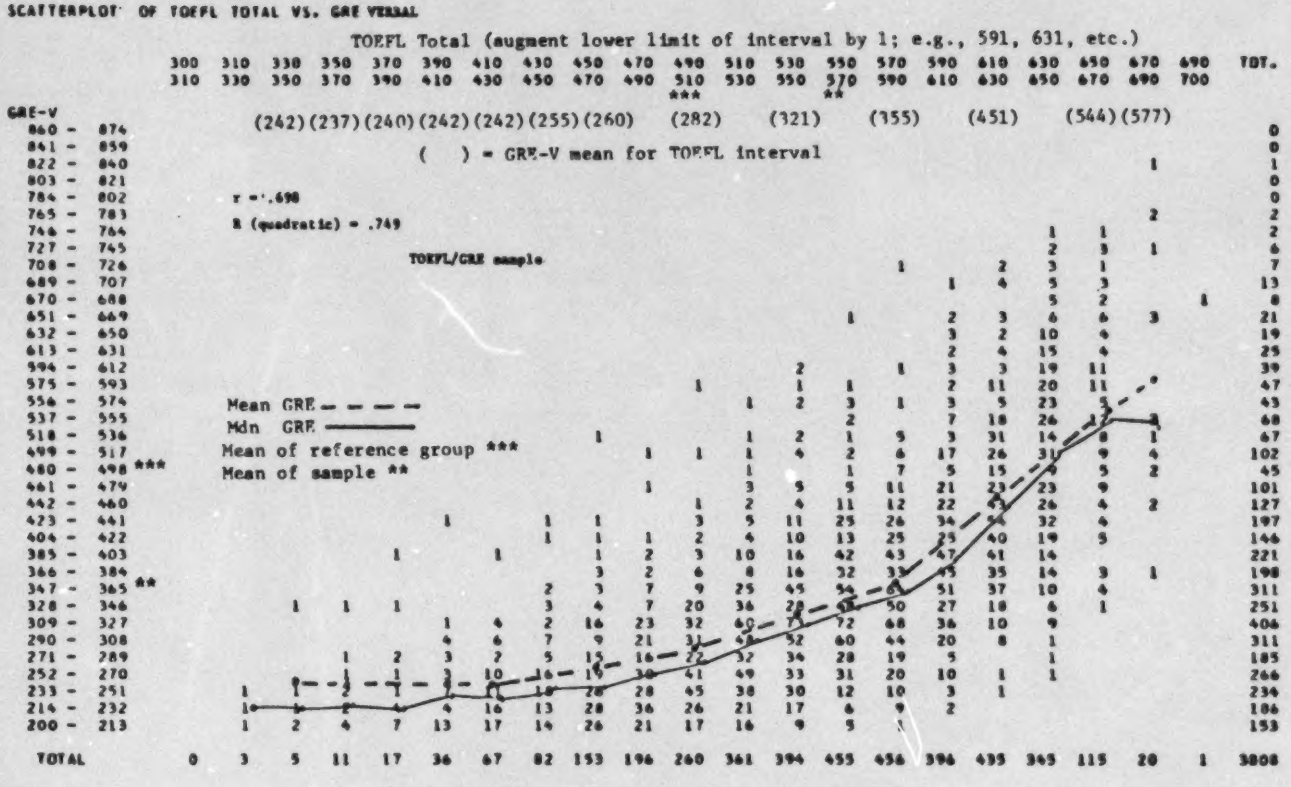

Figure 8. Scatterplot of TOEFL Total and GRE-Verbal scores for TOEFL/GRE-foreign ESL and EPL candidates, 1977-78

- By inspection of the trend line (and the mean values of GRE verbal for candidates in selected TOEFL intervals), it is evident that mean GRE verbal scores tend to increase across successive intervals on TOEFL, except for TOEFL intervals in the 310-430 range; the observed mean GRE verbal scores for successive intervals in this range are almost identical, approximately 240.

  The lack of relationship between TOEFL scores and GRE verbal scores for individuals in the lower ranges of TOEFL may reasonably be attributed to the essential unreliability of GRE verbal scores for foreign candidates with such low TOEFL (and GRE verbal) scores. However, for TOEFL scores above 430, GRE verbal means tend to increase across successive TOEFL intervals at an apparently accelerating rate, with the highest rate of increase observed for TOEFL intervals above 570.

If it is noted that GRE verbal scores of 242 are at approximately the third centile in the national GRE population (i.e., the population reference group for purposes of score reporting), the fact that scores above this point begin to covary positively with TOEFL scores suggests that, despite the very depressed nature of the GRE verbal score distribution for TOEFL/GRE foreign candidates, even very low GRE verbal scores appear to have potential utility as measures of differences in developed verbal reasoning ability, within the population of TOEFL/GRE foreign candidates (and, by inference, in the larger GRE foreign candidate population).

- The pattern of findings reported here with respect to the level and nature of observed TOEFL/GRE verbal relationships in a sample of "regular" TOEFL/GRE candidates is generally similar to that reported by Angelis, Swinton, and Cowell (1979) for a sample of foreign TOEFL candidates who volunteered to take the GRE verbal test. (See Appendix B.3 for cross-tabulations.) However, there are some differences in findings. These appear to be a function of the fact that the sample of volunteers differed rather markedly from the present sample with respect to level and range of scores on GRE verbal (mean/S.D. values of 274/66 as compared to 360/107 in the present sample), as well as on TOEFL (523/69 as opposed to 559/62). For example, an estimated 39 percent of the sample of 186 volunteers scored below 242 on GRE verbal. This is the mean GRE verbal score of candidates in the present TOEFL/GRE sample corresponding to TOEFL scores below 431, the empirically identified point at which GRE verbal scores begin to covary systematically with TOEFL total. In the volunteer sample, systematic covariation between TOEFL total and GRE verbal was not apparent in TOEFL ranges below approximately 470, as compared to about 430 in the present sample. These differences point up the critical importance of identifying the parameters (for TOEFL and GRE tests) that delineate the joint distributions of scores for foreign nationals who regularly are "selected into" joint membership in the pools of candidates taking TOEFL and GRE.

Summary of GRE and TOEFL/GRE Findings

The GRE and TOEFL/GRE analyses that have been reviewed indicate the following:

- Foreign candidates who are selected into the GRE and TOEFL/GRE candidate pools perform as well or better on the GRE quantitative test than do GRE candidates generally; however, these same candidates earn quite low average scores on both GRE verbal and GRE analytical. Among foreign candidates, those who are reportedly less fluent in English than in another language (ESL candidates) have lower verbal and analytical scores than do those reporting English as the language of greatest fluency (EPL candidates).

- The foregoing patterns hold when comparisons are controlled for intended field of graduate study. On the GRE quantitative test, profiles of means for foreign EPL, foreign ESL, and the all-candidate population, by field, are essentially identical with respect to both level and pattern. Profiles of GRE-V means for EPL and ESL groups tend to parallel the all-candidate profile but at depressed levels; EPL profiles are generally at a higher level than ESL profiles.

- GRE foreign EPL candidates who also take TOEFL have lower verbal and analytical means, but substantially higher quantitative means, than do GRE foreign EPL candidates generally. TOEFL/GRE EPL candidates have a higher verbal mean than do their ESL counterparts, but the quantitative and analytical means of EPL and ESL subgroups within the TOEFL/GRE sample are essentially the same. EPL and ESL subgroups are separated to about the same extent by performance on TOEFL as by performance on GRE verbal (point biserial coefficients of .16 and .18, respectively).

- GRE citizen ESL candidates have GRE verbal scores roughly comparable in level to those of GRE foreign EPL candidates generally, but their means on GRE quantitative and analytical are lower than those of both GRE foreign candidates and the general GRE candidate population.

- TOEFL total correlates substantially with GRE verbal ($r = .70$ in the combined EPL and ESL sample) and with the analytical measure ($r = .62$); TOEFL/verbal correlations are higher in the EPL sample ($r = .74$) than in the ESL sample ($r = .66$), as are TOEFL/analytical correlations, but to a lesser extent (.61 vs. .64 for ESL and EPL). Higher TOEFL/verbal correlation in the EPL than in the ESL sample may be attributed, hypothetically, to more reliable assessment of differences in GRE verbal (and analytical) for the EPL than for the ESL sample, for which GRE-V is an extremely difficult test.

- Inferences about the degree of relationship between the skills measured by TOEFL and those measured by GRE verbal (or analytical)

are limited by the fact that the GRE verbal (and analytical) measures are of much greater than average difficulty for the TOEFL/GRE sample, as well as by the fact that these candidates are also highly selected in terms of their scores on TOEFL--over 70 percent of the sample scored above the TOEFL graduate-level reference-group mean and below the GRE all-candidate reference group mean.

- Detailed analysis of the relationship between TOEFL total and GRE verbal scores in the TOEFL/GRE foreign sample indicates that GRE verbal scores tend to increase with increases in TOEFL scores except in the range of TOEFL scores below approximately 430. For TOEFL/GRE foreign candidates below that TOEFL score, mean scores on GRE verbal were essentially stable (at approximately 240) over successive, lower TOEFL intervals.

On balance, the findings strongly suggest that limited English language facility, per se, is a factor (perhaps the major factor) contributing to the depressed score levels of foreign candidates on GRE verbal and GRE analytical tests. Analyses involving the GRE verbal test, however, suggest that, despite the depressed performance levels of foreign candidates, their GRE verbal scores may have significant psychometric viability: except in the lowest ranges of the TOEFL/GRE scales, verbal scores tend to increase systematically with scores on TOEFL.

Section 4. Overview and Evaluation of Findings

This study was undertaken (a) to assess the performance of GMAT and GRE foreign candidates on the two admissions tests in relation to self-reported primary langage (English vs. other), and (b) to analyze relationships between performance on those tests and performance on TOEFL for examinees who took both the GMAT or the GRE and TOEFL.

Analyses that were essentially parallel in nature were conducted for each admissions-test sample. First, attention was focused on differences in the levels and patterns of admissions test scores obtained by EPL and ESL candidates--subgroups assumed to differ in average level of "developed proficiency in English." Then, within each admissions-test foreign candidate sample, detailed analyses were conducted in subsamples identified as also having TOEFL records during the 1977-1979 study period. In these subsamples, analyses were conducted to assess the extent and nature of the relationships between scores on the respective admissions tests and scores on TOEFL in EPL and ESL subgroups. Detailed consideration was given to the characteristics of the distributions and joint distributions of scores on TOEFL and the two admissions tests.

The findings have been examined in detail in the preceding sections. General trends in findings were quite similar across the respective admissions-test samples. Major common themes and related conclusions or observations are summarized below.

- Regardless of differences--cultural, educational, linguistic, and other--that may exist between foreign candidates and the "majority" candidate populations of the admissions tests, the average (mean) performance of foreign candidates on the quantitative sections of GRE or GMAT equals or exceeds that of the respective admissions-test populations. This holds not only for foreign EPL and ESL samples generally, but also for subgroups selected into TOEFL candidacy.

- In sharp contrast, the means of foreign candidates, both EPL and ESL, on the verbal sections of GRE and GMAT (and also on the analytical GRE measure) fall substantially below the means of the respective admissions-test populations and, by inference, well below the average level of verbal performance expected on the basis of their performance on the quantitative tests (comparable to that of the general candidate populations). However, among the foreign admissions-test candidates generally (and to a lesser extent in the subgroups also taking TOEFL), the mean verbal admissions-test performance of EPL candidates exceeds that of ESL candidates.

- Within both the GMAT and GRE foreign candidate populations, the subgroups also taking TOEFL are highly selected members of the TOEFL candidate population with respect to level of developed English language proficiency as measured by TOEFL performance (mean TOEFL total of 553 and 559 for GMAT and GRE samples,

respectively). EPL TOEFL candidates outperform their TOEFL ESL counterparts on TOEFL (as well as on the verbal sections of the two admissions tests); percentile ranks (graduate-level distribution) of TOEFL total means were 89 and 84 for EPL, and 71 and 76 for ESL candidates in the TOEFL/GMAT and TOEFL/GRE samples, respectively.

- o TOEFL total scores are substantially correlated with GMAT and GRE verbal scores (and to a slightly lesser extent with GRE analytical scores), but are only weakly correlated with the quantitative sections of the admissions tests. Generally speaking, TOEFL/quantitative-test correlations are weaker than verbal/quantitative admissions-test correlations.

- o Observed TOEFL/verbal admissions-test correlations were systematically higher in EPL than in ESL subgroups. Overall correlational results were remarkably similar across admissions-test samples. In the GRE sample, TOEFL total/GRE verbal coefficients were .74, .70, and .66 for EPL, combined EPL/ESL, and ESL analyses, respectively; comparable TOEFL total/GMAT verbal analyses yielded coefficients of .76, .71, and .68. Correlations computed under the assumption of curvilinearity were slightly higher than the foregoing.

- o The higher TOEFL/verbal correlations in EPL than in ESL subgroups may be attributed, hypothetically, to the likelihood that, because of the greater average level of English proficiency in the EPL samples, the verbal admissions tests are psychometrically more appropriate for these samples than for their ESL counterparts, for whom the verbal admissions tests are particularly difficult.

- o Inferences from the level of the observed correlations regarding the degree or nature of relationship between the skills measured by TOEFL and those measured by the verbal admissions tests are limited by the fact that both GRE-V and GMAT-V are of much greater than average difficulty for TOEFL/admissions-test candidates, while TOEFL is of considerably less than average difficulty for these candidates. Reliability of observed scores is attenuated in groups scoring at the extremes on standardized tests generally.[15]

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[15] In an analysis of TOEFL/GRE verbal relationships in a sample of TOEFL candidates who volunteered to take GRE verbal, Angelis, Swinton, and Cowell (1979) computed reliability coefficients for the verbal test and its components. The coefficient reported for GRE verbal was .78, as compared to a reported coefficient of .94 for a group of GRE candidates who were "native speakers" of English. The reliability of the reading comprehension subsection of GRE verbal in the TOEFL/GRE sample was reported as .47, compared to .84 reported for a general reference group. The GRE verbal measure was unusually difficult for this group of TOEFL candidates.

- Interpretation of observed relationships between TOEFL and verbal admissions tests is complicated by basic psychometric considerations unrelated to the skills measured by the tests. Theoretically, easier "levels" of verbal admissions tests and somewhat more difficult "levels" of TOEFL should provide more reliable assessments, hence better bases for evaluating observed relationships between TOEFL and standard verbal admissions tests.

- Detailed analyses of the relationship between TOEFL total and the two verbal admissions tests suggest that, despite the "depressed" and positively skewed nature of the verbal score distributions for TOEFL/admissions-test candidates, the verbal admissions-test scores tend to have significant psychometric viability in the sense that they tend to increase systematically with scores on TOEFL, except in the lowest sector of the joint TOEFL/verbal test score distribution. From this juncture of very low TOEFL and very low admissions scores, the relationship between TOEFL total and the verbal scores becomes increasingly robust in the upper TOEFL score range--in which the mean verbal scores of candidates begin to equal or exceed the mean for the general admissions-test candidate populations.

General Conclusions

The pattern of findings warrants several general conclusions, which are offered tentatively in the form of working hypotheses for future consideration.

1. With respect to the verbal sections of standard admissions tests, except for scores in the lowest centiles, the observed verbal scores of foreign candidates have a useful degree of "interpretability" in the sense of permitting valid inferences regarding within-group differences in relative level of developed "verbal reasoning ability"--i.e., the verbal performance of one foreign candidate may meaningfully be compared with the observed verbal performance of another but not with that of majority (English-speaking) candidates.

   - This hypothesis is strengthened by evidence from scattered studies of the predictive validity of scores on verbal tests (such as GRE verbal, GMAT verbal, and the Law School Admission Test). Results of these studies indicate that, within samples of foreign students, differences in verbal scores are significantly related to differences in actual academic performance as measured by grade-point average (e.g., Harvey & Lannholm, 1961; Harvey & Pitcher, 1963; Sharon, 1971; Schrader & Pitcher, 1976; Wilson, 1979; several unpublished GMAT validity studies).

   - Additional support for this hypothesis is provided, albeit indirectly, in findings of a study by Alderman (1981). In a

sample composed primarily of college-bound high school ESL students in Puerto Rico, Alderman found that the relationship between College Board Scholastic Aptitude Test verbal (SAT-V) scores and verbal scores on the Prueba de Aptitud Academica (PAA-V)--constructed specifically to parallel the verbal content of the SAT-V measure in the Spanish language--increased substantially as scores on TOEFL increased. In the present context it is most relevant to note (a) that Alderman's sample had a mean TOEFL total of about 435 (almost two standard deviations below the mean of the TOEFL/GRE and TOEFL/GMAT candidate populations), (b) that the PAA-V/SAT-V relationship was strongest at TOEFL score levels in the range above 500 (well below the TOEFL means for the candidate populations under consideration in the present study), and (c) that in the total Puerto Rican sample, which again was characterized by a comparatively low average TOEFL total score, the PAA-V/SAT-V relationship was still moderately strong, $r = .67$. It is reasonable to infer that, in samples of admissions test candidates averaging above 550 on TOEFL, obtained scores on verbal measures in English are likely to have a useful degree of "interpretability."

2. Although foreign ESL candidates earn much lower average scores on verbal admissions tests than do their U.S. citizen counterparts, it does not follow that differences in average performance on these tests validly reflect differences in functional level of developed English-language verbal or analytical reasoning ability or that, after foreign ESL students are admitted to graduate programs, their average level of academic performance will be like that of U.S. citizen students with comparably low verbal (or analytical) scores.

   - A major factor associated with less than "native familiarity" with the English language is likely to be diminished speed of performance of tasks involving verbal processing (e.g., lower reading speed). Available evidence, although limited, indicates that foreign candidates have lower completion rates than U.S. citizen candidates on both GRE verbal (Angelis, Swinton, & Cowell, 1979) and GMAT verbal (Sinnott, 1980)--i.e., that these tests have a greater degree of speededness for foreign than for U.S. citizen candidates.

   - These findings are consistent with research on speed of processing and language dominance, reviewed by Dornic (1980), that focused primarily on "...decoding (comprehension) and encoding (production) of spoken language" (emphasis added).

   - Research is needed to establish the average levels of performance attainable by foreign ESL candidates on verbal admissions tests under essentially unspeeded conditions. Given the logical and theoretical significance of speed of verbal processing in a nondominant language, there would also appear

to be a potentially important role in English-language testing for separate measures of speed and level of comprehension.

- o It is reasonable to hypothesize that, under normal conditions of academic life, foreign ESL students, on the average, may be able to compensate for their relatively low speed of verbal-task completion by spending more time-on-task than their U.S. citizen classmates. If so, their general level of academic performance would tend to be higher than that expected based on their performance on a "speeded" standardized test of verbal ability.

- o Since many quantitative test items are embedded in an English-language matrix, it is possible that these measures may also be somewhat more "speeded" for foreign than for U.S. citizen candidates. Generally speaking, research is needed to ascertain the relative speededness of quantitative ability measures for foreign and citizen candidates, notwithstanding the fact that the quantitative performance of foreign and citizen candidates is, on the average, at the same level.

- o In any event, questions regarding the comparative predictive value of standard admissions tests for foreign and U.S. citizen students require empirical answers. It is important to extend the comparatively limited body of validity study evidence currently available by conducting studies designed to assess the comparative performance of foreign and U.S. citizen students who have similar scores on verbal and other standard admissions tests.

3. With respect to TOEFL, the findings of this study contribute further evidence of the test's value (a) for reliably assessing differences in developed proficiency in English for admissions-test candidates whose English language background is questionable and (b) for the purpose of identifying subgroups within such a candidate population whose verbal admissions-test scores are likely to have differing degrees of interpretability and usefulness in the admissions process.

   - o Institutional-level studies of the relationship between scores on TOEFL and scores on standard admissions tests should be conducted since the characteristics of the joint distribution of TOEFL/admissions-test scores for foreign applicant populations may vary considerably across institutions. For example, each institution should determine, for its own population of foreign applicants, the TOEFL score level above which scores on TOEFL and scores on verbal admissions tests begin to vary together, systematically, by developing scatterplots such as those shown in this study for TOEFL-admissions test candidates generally.

- o From the point of view of English language testing per se, as suggested earlier, consideration should be given to the potential role of separate measures of speed and level of comprehension involving both written and spoken materials.

4. Because foreign nationals for whom English is not the dominant language are an increasingly significant segment of the population of candidates taking standardized admissions tests such as the GRE and GMAT, it is important to reiterate the need for research on (a) test speededness for foreign candidates and (b) the predictive validity of the admissions tests for foreign students, with attention to the role of TOEFL scores in the interpretation of validity study findings.

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Appendix A

A.1 Groups of Disciplines Used in "Major Area" GRE Analysis

A.2 GRE Aptitude Test statistics, by sex and intended graduate field: TOEFL/GRE EPL candidates, 1977-78

A.3 GRE Aptitude Test statistics, by sex and intended graduate field: TOEFL/GRE ESL candidates, 1977-78

A.4 GRE Aptitude Test statistics for citizen ESL GRE candidates, 1977-78: By sex and intended graduate area of study

A.5 GRE Aptitude Test statistics for foreign EPL candidates, 1977-78: By sex and intended graduate area of study

A.5 GRE Aptitude Test statistics for foreign ESL candidates, 1977-78: By sex and intended graduate area of study

A.1

Groups of Disciplines Used in "Major area" GRE Analysis (cf. Figure 5)

Humanities:

Arts-Dramatic Art	Other Humanities-Archaeology		Architecture
Music		Art History	Classical Lang.
Fine Arts		Comparative Lit.	English
		Far Eastern Lang.	French
		German	Italian
		Linguistics	Near Eastern Lang.
		Philosophy	Religion
		Russian	Spanish
		Speech	Other Foreign Lang.
		Other Humanities	

Social Sciences:

Education-Education	Other Social Sciences-Business		
Educational Admin.		Communications	
Educational Psych.		Industrial Relations	
Guidance		Journalism	
Physical Education		Law	
		Library Science	
		Public Administration	
		Social Work	
Behavioral Sciences-American Studies			Anthropology
	Economics		Geography
	Government		History
	International Rel.		Psychology
	Slavic Study		Social Psychology
	Sociology		Urban Development
	Other Social Sciences		Political Science

Biological Sciences:

Biosciences-Biochemistry		Health-Anatomy	
Biology		Audiology	
Biophysics		Bacteriology	
Botany		Dentistry	
Genetics		Health Admin.	
Microbiology		Medicine	
Physiology		Nursing	
Zoology		Nutrition	
Other Biological Sci.		Occupational Therapy	
		Optometry	
		Osteopathy	
		Parasitology	
		Pathology	
		Pharmacology	
		Pharmacy	
		Physical Therapy	
		Public Health	

Physical Sciences

Engineering-Aeronautical Eng.	Math. Science-Applied Mathematics		
Chemical Eng.		Computer Science	
Civil Eng.		Mathematics	
Electrical Eng.		Statistics	
Industrial Eng.			
Mechanical Eng.	Physical Science-Astronomy		
Other Eng.		Chemistry	
Metallurgy		Physics	
Mining		Geology	
		Oceanography	
		Other Physical Sciences	

TOEFL/GRE FOREIGN EFL

GRE-V MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	1	6	0	7
	MEAN	520	400	0	417
	S.D.	0	85	0	89
OTHER HUMANITIES	N	19	25	0	44
	MEAN	391	426	0	410
	S.D.	111	143	0	132
EDUCATION	N	14	21	0	35
	MEAN	403	379	0	389
	S.D.	132	144	0	140
SOCIAL SCIENCE	N	46	29	0	75
	MEAN	366	419	0	386
	S.D.	111	146	0	129
BEHAVIORAL SCIENCE	N	84	66	0	150
	MEAN	410	381	0	398
	S.D.	140	114	0	130
BIOLOGICAL SCIENCE	N	43	31	0	74
	MEAN	370	381	0	374
	S.D.	113	102	0	109
HEALTH	N	34	26	0	60
	MEAN	349	338	0	344
	S.D.	85	91	0	88
APPLIED BIOLOGY	N	24	8	0	32
	MEAN	353	328	0	347
	S.D.	103	87	0	100
ENGINEERING	N	496	7	0	503
	MEAN	391	370	0	391
	S.D.	120	100	0	120
MATH SCIENCE	N	104	29	0	133
	MEAN	404	365	0	395
	S.D.	126	117	0	125
PHYSICAL SCIENCE	N	99	20	0	119
	MEAN	391	353	0	384
	S.D.	124	110	0	122
NOT IN ABOVE	N	15	1	0	16
	MEAN	393	670	0	410
	S.D.	112	0	0	126
UNDECIDED	N	62	21	0	83
	MEAN	345	385	0	355
	S.D.	114	123	0	116
NO RESPONSE	N	26	12	0	38
	MEAN	398	368	0	394
	S.D.	140	123	0	135
TOTAL	N	1067	302	0	1369
	MEAN	387	381	0	386
	S.D.	122	123	0	122

GRE-Q MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	1	6	0	7
	MEAN	580	527	0	523
	S.D.	0	56	0	53
OTHER HUMANITIES	N	19	25	0	44
	MEAN	536	472	0	500
	S.D.	147	103	0	126
EDUCATION	N	14	21	0	35
	MEAN	474	467	0	469
	S.D.	119	141	0	133
SOCIAL SCIENCE	N	46	29	0	75
	MEAN	469	480	0	473
	S.D.	126	119	0	123
BEHAVIORAL SCIENCE	N	84	66	0	150
	MEAN	562	510	0	539
	S.D.	130	141	0	142
BIOLOGICAL SCIENCE	N	43	31	0	74
	MEAN	566	522	0	547
	S.D.	120	100	0	114
HEALTH	N	34	26	0	60
	MEAN	521	523	0	522
	S.D.	149	159	0	149
APPLIED BIOLOGY	N	24	8	0	32
	MEAN	520	509	0	517
	S.D.	129	121	0	128
ENGINEERING	N	496	7	0	503
	MEAN	664	636	0	664
	S.D.	99	87	0	98
MATH SCIENCE	N	104	29	0	133
	MEAN	681	668	0	678
	S.D.	101	99	0	99
PHYSICAL SCIENCE	N	99	20	0	119
	MEAN	622	576	0	615
	S.D.	103	106	0	105
NOT IN ABOVE	N	15	1	0	16
	MEAN	593	530	0	589
	S.D.	121	0	0	118
UNDECIDED	N	62	21	0	83
	MEAN	596	566	0	589
	S.D.	125	113	0	122
NO RESPONSE	N	26	12	0	38
	MEAN	620	605	0	615
	S.D.	120	88	0	111
TOTAL	N	1067	302	0	1369
	MEAN	623	534	0	603
	S.D.	126	134	0	133

GRE-A MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

		MALE	FEMALE	NO RESPONSE	TOTAL
	N	1	6	0	7
	MEAN	410	395	0	397
	S.D.	0	68	0	64
	N	19	25	0	44
	MEAN	488	485	0	487
	S.D.	105	111	0	108
	N	14	21	0	35
	MEAN	351	360	0	356
	S.D.	109	119	0	112
	N	46	29	0	75
	MEAN	345	393	0	376
	S.D.	117	125	0	121
	N	84	66	0	150
	MEAN	423	377	0	403
	S.D.	126	117	0	124
	N	43	31	0	74
	MEAN	398	374	0	383
	S.D.	117	88	0	106
	N	34	26	0	60
	MEAN	324	369	0	344
	S.D.	76	90	0	85
	N	24	8	0	32
	MEAN	359	393	0	367
	S.D.	85	135	0	101
	N	496	7	0	503
	MEAN	423	463	0	424
	S.D.	116	119	0	116
	N	104	29	0	133
	MEAN	449	440	0	447
	S.D.	119	107	0	117
	N	99	20	0	119
	MEAN	404	398	0	402
	S.D.	128	125	0	128
	N	15	1	0	16
	MEAN	407	870	0	418
	S.D.	116	0	0	119
	N	62	21	0	83
	MEAN	365	394	0	372
	S.D.	120	112	0	119
	N	26	12	0	38
	MEAN	402	422	0	408
	S.D.	110	77	0	102
	N	1067	302	0	1369
	MEAN	410	392	0	406
	S.D.	120	113	0	119

A.2. GRE Aptitude Test statistics, by sex and intended graduate field: TOEFL/GRE EFL

TOEFL/GRE FOREIGN ESL

GRE-V MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	14	17	0	31
	MEAN	338	299	0	316
	S.D.	83	49	0	69
OTHER HUMANITIES	N	83	98	0	181
	MEAN	349	361	0	355
	S.D.	97	84	0	90
EDUCATION	N	36	43	0	79
	MEAN	306	325	0	316
	S.D.	83	99	0	93
SOCIAL SCIENCE	N	98	58	0	156
	MEAN	332	312	0	325
	S.D.	86	75	0	82
BEHAVIORAL SCIENCE	N	251	119	0	370
	MEAN	364	363	0	364
	S.D.	93	103	0	96
BIOLOGICAL SCIENCE	N	83	41	0	124
	MEAN	336	352	0	341
	S.D.	91	90	0	91
HEALTH	N	45	38	0	83
	MEAN	335	315	0	326
	S.D.	77	77	0	78
APPLIED BIOLOGY	N	35	15	0	50
	MEAN	319	277	0	306
	S.D.	88	61	0	83
ENGINEERING	N	734	34	0	768
	MEAN	348	361	0	349
	S.D.	97	101	0	97
MATH SCIENCE	N	170	27	0	197
	MEAN	355	329	0	351
	S.D.	111	89	0	108
PHYSICAL SCIENCE	N	151	30	0	181
	MEAN	361	323	0	354
	S.D.	98	100	0	99
NOT IN ABOVE	N	32	20	0	52
	MEAN	332	300	0	320
	S.D.	96	56	0	83
UNDECIDED	N	88	36	0	124
	MEAN	321	318	0	320
	S.D.	85	61	0	79
NO RESPONSE	N	42	13	0	55
	MEAN	360	362	0	361
	S.D.	90	72	0	86
TOTAL	N	1862	589	0	2451
	MEAN	347	338	0	345
	S.D.	96	91	0	95

GRE-Q MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	14	17	0	31
	MEAN	451	433	0	441
	S.D.	139	118	0	129
OTHER HUMANITIES	N	83	98	0	181
	MEAN	560	487	0	521
	S.D.	127	145	0	142
EDUCATION	N	36	43	0	79
	MEAN	498	473	0	485
	S.D.	142	120	0	131
SOCIAL SCIENCE	N	98	58	0	156
	MEAN	553	491	0	538
	S.D.	123	151	0	137
BEHAVIORAL SCIENCE	N	251	119	0	370
	MEAN	588	513	0	564
	S.D.	135	116	0	133
BIOLOGICAL SCIENCE	N	83	41	0	124
	MEAN	564	531	0	553
	S.D.	119	135	0	125
HEALTH	N	45	38	0	83
	MEAN	573	550	0	562
	S.D.	145	131	0	139
APPLIED BIOLOGY	N	35	15	0	50
	MEAN	549	607	0	566
	S.D.	107	90	0	105
ENGINEERING	N	734	34	0	768
	MEAN	673	624	0	671
	S.D.	97	101	0	98
MATH SCIENCE	N	170	27	0	197
	MEAN	683	636	0	676
	S.D.	100	111	0	103
PHYSICAL SCIENCE	N	151	30	0	181
	MEAN	663	603	0	653
	S.D.	107	125	0	112
NOT IN ABOVE	N	32	20	0	52
	MEAN	568	537	0	556
	S.D.	130	124	0	129
UNDECIDED	N	88	36	0	124
	MEAN	625	557	0	605
	S.D.	135	152	0	143
NO RESPONSE	N	42	13	0	55
	MEAN	648	543	0	623
	S.D.	119	164	0	138
TOTAL	N	1862	589	0	2451
	MEAN	631	528	0	606
	S.D.	126	139	0	136

GRE-A MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	14	17	0	31
	MEAN	332	326	0	329
	S.D.	78	78	0	78
OTHER HUMANITIES	N	83	98	0	181
	MEAN	387	393	0	390
	S.D.	110	105	0	107
EDUCATION	N	36	43	0	79
	MEAN	329	353	0	342
	S.D.	103	99	0	102
SOCIAL SCIENCE	N	98	58	0	156
	MEAN	369	362	0	366
	S.D.	96	105	0	99
BEHAVIORAL SCIENCE	N	251	119	0	370
	MEAN	411	399	0	407
	S.D.	115	109	0	113
BIOLOGICAL SCIENCE	N	83	41	0	124
	MEAN	367	386	0	373
	S.D.	122	112	0	119
HEALTH	N	45	38	0	83
	MEAN	369	346	0	358
	S.D.	102	79	0	93
APPLIED BIOLOGY	N	35	15	0	50
	MEAN	364	369	0	366
	S.D.	105	101	0	104
ENGINEERING	N	734	34	0	768
	MEAN	420	402	0	419
	S.D.	112	129	0	113
MATH SCIENCE	N	170	27	0	197
	MEAN	429	406	0	426
	S.D.	120	102	0	118
PHYSICAL SCIENCE	N	151	30	0	181
	MEAN	427	380	0	419
	S.D.	116	136	0	121
NOT IN ABOVE	N	32	20	0	52
	MEAN	374	328	0	356
	S.D.	112	56	0	97
UNDECIDED	N	88	36	0	124
	MEAN	384	385	0	384
	S.D.	117	96	0	111
NO RESPONSE	N	42	13	0	55
	MEAN	415	378	0	406
	S.D.	105	117	0	109
TOTAL	N	1862	589	0	2451
	MEAN	406	379	0	400
	S.D.	115	108	0	114

A.3. GRE Aptitude Test statistics, by sex and intended graduate field: TOEFL/GRE ESL

GRE-V MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Citizen ESL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	37	31	0	68
	MEAN	432	418	0	426
	S.D.	97	117	0	107
OTHER HUMANITIES	N	156	192	3	351
	MEAN	468	457	387	461
	S.D.	145	133	61	139
EDUCATION	N	177	357	2	536
	MEAN	380	392	450	388
	S.D.	112	115	30	114
SOCIAL SCIENCE	N	168	160	3	331
	MEAN	416	447	477	432
	S.D.	130	121	123	127
BEHAVIORAL SCIENCE	N	302	231	7	540
	MEAN	451	458	524	455
	S.D.	130	126	123	129
BIOLOGICAL SCIENCE	N	105	121	2	228
	MEAN	436	419	405	426
	S.D.	124	124	15	124
HEALTH	N	87	168	2	257
	MEAN	450	439	360	442
	S.D.	120	127	0	125
APPLIED BIOLOGY	N	48	23	1	72
	MEAN	402	452	660	422
	S.D.	117	140	0	129
ENGINEERING	N	191	15	2	209
	MEAN	399	443	380	402
	S.D.	110	118	10	111
MATH SCIENCE	N	59	42	1	102
	MEAN	434	374	600	411
	S.D.	126	69	0	117
PHYSICAL SCIENCE	N	71	11	1	83
	MEAN	465	434	660	463
	S.D.	126	158	0	132
NOT IN ABOVE	N	39	53	0	92
	MEAN	410	436	0	425
	S.D.	119	128	0	125
UNDECIDED	N	72	102	0	174
	MEAN	460	414	0	433
	S.D.	143	121	0	132
NO RESPONSE	N	27	24	0	51
	MEAN	456	445	0	451
	S.D.	132	138	0	135
TOTAL	N	1539	1530	24	3093
	MEAN	431	428	474	430
	S.D.	129	126	120	127

GRE-Q MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Citizen ESL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	37	31	0	68
	MEAN	439	428	0	433
	S.D.	106	117	0	111
OTHER HUMANITIES	N	156	192	3	351
	MEAN	451	409	383	428
	S.D.	139	114	131	127
EDUCATION	N	177	357	2	536
	MEAN	393	380	390	385
	S.D.	120	115	110	117
SOCIAL SCIENCE	N	168	160	3	331
	MEAN	455	419	450	438
	S.D.	134	112	102	126
BEHAVIORAL SCIENCE	N	302	231	7	540
	MEAN	466	430	477	451
	S.D.	121	119	106	122
BIOLOGICAL SCIENCE	N	105	121	2	228
	MEAN	523	477	420	497
	S.D.	117	121	60	121
HEALTH	N	87	168	2	257
	MEAN	519	447	375	471
	S.D.	132	125	65	132
APPLIED BIOLOGY	N	48	23	1	72
	MEAN	491	481	620	489
	S.D.	109	154	0	126
ENGINEERING	N	191	15	2	208
	MEAN	621	612	650	620
	S.D.	111	147	20	116
MATH SCIENCE	N	59	42	1	102
	MEAN	628	576	730	607
	S.D.	109	95	0	107
PHYSICAL SCIENCE	N	71	11	1	83
	MEAN	612	534	480	608
	S.D.	111	98	0	110
NOT IN ABOVE	N	39	53	0	92
	MEAN	448	424	0	434
	S.D.	131	110	0	120
UNDECIDED	N	72	102	0	174
	MEAN	506	420	0	456
	S.D.	158	126	0	147
NO RESPONSE	N	27	24	0	51
	MEAN	463	428	0	446
	S.D.	166	127	0	150
TOTAL	N	1539	1530	24	3093
	MEAN	496	427	473	462
	S.D.	144	126	132	140

GRE-A MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Citizen ESL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	37	31	0	68
	MEAN	439	401	0	422
	S.D.	117	118	0	119
OTHER HUMANITIES	N	156	192	3	351
	MEAN	433	419	373	425
	S.D.	136	127	96	131
EDUCATION	N	177	357	2	536
	MEAN	355	382	450	373
	S.D.	110	123	60	120
SOCIAL SCIENCE	N	168	160	3	331
	MEAN	410	422	417	416
	S.D.	133	121	152	126
BEHAVIORAL SCIENCE	N	302	231	7	540
	MEAN	420	439	537	430
	S.D.	136	132	130	135
BIOLOGICAL SCIENCE	N	105	121	2	228
	MEAN	451	418	455	434
	S.D.	135	130	45	133
HEALTH	N	87	168	2	257
	MEAN	450	428	250	434
	S.D.	131	136	20	135
APPLIED BIOLOGY	N	48	23	1	72
	MEAN	404	445	620	420
	S.D.	145	163	0	153
ENGINEERING	N	191	15	2	208
	MEAN	456	460	405	456
	S.D.	119	154	45	121
MATH SCIENCE	N	59	42	1	102
	MEAN	488	462	560	478
	S.D.	118	107	0	114
PHYSICAL SCIENCE	N	71	11	1	83
	MEAN	493	467	640	491
	S.D.	133	131	0	133
NOT IN ABOVE	N	39	53	0	92
	MEAN	402	408	0	406
	S.D.	137	132	0	134
UNDECIDED	N	72	102	0	174
	MEAN	458	398	0	423
	S.D.	141	143	0	145
NO RESPONSE	N	27	24	0	51
	MEAN	442	460	0	451
	S.D.	144	160	0	152
TOTAL	N	1539	1530	24	3093
	MEAN	429	415	461	422
	S.D.	135	132	139	133

A.4. GRE Aptitude Test statistics for citizen-ESL candidates, 1977-78: By sex and intended graduate area of study

GRE-V MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Foreign EPL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	108	115	1	224
	MEAN	496	482	650	490
	S.D.	137	135	0	136
OTHER HUMANITIES	N	438	381	3	822
	MEAN	506	523	583	514
	S.D.	148	147	134	148
EDUCATION	N	428	577	10	1015
	MEAN	440	432	498	436
	S.D.	126	134	150	131
SOCIAL SCIENCE	N	501	409	6	916
	MEAN	399	445	392	420
	S.D.	129	136	134	134
BEHAVIORAL SCIENCE	N	1230	853	11	2094
	MEAN	471	492	426	479
	S.D.	142	136	104	140
BIOLOGICAL SCIENCE	N	432	267	4	703
	MEAN	443	465	358	451
	S.D.	138	138	85	138
HEALTH	N	290	404	6	700
	MEAN	393	426	403	412
	S.D.	121	126	140	125
APPLIED BIOLOGY	N	237	125	1	363
	MEAN	414	448	580	426
	S.D.	129	126	0	129
ENGINEERING	N	1717	53	8	1778
	MEAN	388	410	309	381
	S.D.	120	126	51	120
MATH SCIENCE	N	413	111	3	527
	MEAN	422	376	427	412
	S.D.	150	143	164	150
PHYSICAL SCIENCE	N	515	114	3	632
	MEAN	432	431	333	431
	S.D.	146	147	81	145
NOT IN ABOVE	N	170	110	2	282
	MEAN	405	458	395	426
	S.D.	125	128	125	129
UNDECIDED	N	451	304	5	760
	MEAN	389	419	302	400
	S.D.	133	142	37	138
NO RESPONSE	N	184	110	4	298
	MEAN	380	441	370	402
	S.D.	137	136	150	140
TOTAL	N	7114	3933	67	11114
	MEAN	423	457	409	435
	S.D.	139	141	141	141

GRE-Q MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Foreign EPL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	108	115	1	224
	MEAN	493	463	670	478
	S.D.	141	112	0	128
OTHER HUMANITIES	N	438	381	3	822
	MEAN	534	475	427	507
	S.D.	135	127	73	134
EDUCATION	N	428	577	10	1015
	MEAN	486	430	460	454
	S.D.	125	130	149	131
SOCIAL SCIENCE	N	501	409	6	916
	MEAN	481	452	468	468
	S.D.	140	123	98	133
BEHAVIORAL SCIENCE	N	1230	853	11	2094
	MEAN	529	498	456	516
	S.D.	136	118	118	130
BIOLOGICAL SCIENCE	N	432	267	4	703
	MEAN	564	551	465	558
	S.D.	131	113	126	124
HEALTH	N	290	404	6	700
	MEAN	524	470	513	493
	S.D.	131	133	121	135
APPLIED BIOLOGY	N	237	125	1	363
	MEAN	541	551	710	545
	S.D.	134	119	0	129
ENGINEERING	N	1717	53	8	1778
	MEAN	647	620	564	646
	S.D.	106	108	87	106
MATH SCIENCE	N	413	111	3	527
	MEAN	671	657	650	668
	S.D.	118	95	166	114
PHYSICAL SCIENCE	N	515	114	3	632
	MEAN	632	607	627	627
	S.D.	121	117	85	121
NOT IN ABOVE	N	170	110	2	282
	MEAN	530	474	435	508
	S.D.	134	121	5	133
UNDECIDED	N	451	304	5	760
	MEAN	557	500	486	534
	S.D.	147	141	139	147
NO RESPONSE	N	184	110	4	298
	MEAN	559	515	553	543
	S.D.	140	141	96	142
TOTAL	N	7114	3933	67	11114
	MEAN	572	492	506	543
	S.D.	142	134	134	144

GRE-A MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Foreign EPL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	108	115	1	224
	MEAN	463	457	640	461
	S.D.	132	122	0	128
OTHER HUMANITIES	N	438	381	3	822
	MEAN	482	476	423	479
	S.D.	142	136	66	139
EDUCATION	N	428	577	10	1015
	MEAN	422	420	422	421
	S.D.	135	133	165	134
SOCIAL SCIENCE	N	501	409	6	916
	MEAN	391	425	365	406
	S.D.	134	131	128	133
BEHAVIORAL SCIENCE	N	1230	853	11	2094
	MEAN	458	480	395	466
	S.D.	145	134	140	141
BIOLOGICAL SCIENCE	N	432	267	4	703
	MEAN	451	472	385	458
	S.D.	146	139	176	144
HEALTH	N	290	404	6	700
	MEAN	390	422	408	408
	S.D.	126	130	173	130
APPLIED BIOLOGY	N	237	125	1	363
	MEAN	422	481	640	443
	S.D.	147	148	0	150
ENGINEERING	N	1717	53	8	1778
	MEAN	416	468	388	417
	S.D.	122	126	85	123
MATH SCIENCE	N	413	111	3	527
	MEAN	462	443	473	458
	S.D.	144	135	158	142
PHYSICAL SCIENCE	N	515	114	3	632
	MEAN	447	457	383	448
	S.D.	156	137	46	152
NOT IN ABOVE	N	170	110	2	282
	MEAN	421	454	425	434
	S.D.	135	137	125	137
UNDECIDED	N	451	304	5	760
	MEAN	402	430	284	412
	S.D.	140	140	57	140
NO RESPONSE	N	184	110	4	298
	MEAN	393	439	400	410
	S.D.	131	129	116	132
TOTAL	N	7114	3933	67	11114
	MEAN	432	450	392	438
	S.D.	140	136	145	139

A.5. GRE Aptitude Test statistics for foreign EPL candidates, 1977-78: By sex and intended graduate area of study

GRE-V MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Foreign ESL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	59	64	0	123
	MEAN	352	324	0	338
	S.D.	105	84	0	98
OTHER HUMANITIES	N	410	423	4	837
	MEAN	353	391	378	372
	S.D.	97	102	95	101
EDUCATION	N	256	264	4	524
	MEAN	317	341	370	329
	S.D.	83	100	112	93
SOCIAL SCIENCE	N	584	277	12	873
	MEAN	326	336	288	329
	S.D.	91	98	49	93
BEHAVIORAL SCIENCE	N	1161	533	12	1706
	MEAN	361	376	371	366
	S.D.	104	108	77	105
BIOLOGICAL SCIENCE	N	371	201	5	577
	MEAN	349	365	320	354
	S.D.	92	113	43	100
HEALTH	N	284	221	4	509
	MEAN	339	331	355	336
	S.D.	79	85	114	82
APPLIED BIOLOGY	N	237	54	2	293
	MEAN	328	338	270	329
	S.D.	89	103	10	92
ENGINEERING	N	2723	116	19	2858
	MEAN	334	347	304	334
	S.D.	88	85	65	88
MATH SCIENCE	N	622	165	5	792
	MEAN	338	319	300	334
	S.D.	95	84	105	93
PHYSICAL SCIENCE	N	592	110	4	706
	MEAN	340	321	335	337
	S.D.	92	85	137	91
NOT IN ABOVE	N	183	85	2	270
	MEAN	321	332	230	324
	S.D.	98	78	30	85
UNDECIDED	N	500	248	5	753
	MEAN	323	333	274	326
	S.D.	93	90	65	92
NO RESPONSE	N	253	95	3	351
	MEAN	332	355	397	339
	S.D.	91	86	85	91
TOTAL	N	8235	2856	81	11172
	MEAN	338	353	322	342
	S.D.	93	101	88	95

GRE-M MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Foreign ESL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	59	64	0	123
	MEAN	481	484	0	482
	S.D.	121	118	0	120
OTHER HUMANITIES	N	410	423	4	837
	MEAN	524	475	540	499
	S.D.	147	137	101	144
EDUCATION	N	256	264	4	524
	MEAN	443	457	460	450
	S.D.	134	130	127	132
SOCIAL SCIENCE	N	584	277	12	873
	MEAN	523	511	438	518
	S.D.	140	150	161	144
BEHAVIORAL SCIENCE	N	1161	533	12	1706
	MEAN	536	496	532	524
	S.D.	141	127	144	138
BIOLOGICAL SCIENCE	N	371	201	5	577
	MEAN	552	546	608	551
	S.D.	130	129	73	129
HEALTH	N	284	221	4	509
	MEAN	557	525	470	543
	S.D.	134	151	29	144
APPLIED BIOLOGY	N	237	54	2	293
	MEAN	509	588	355	522
	S.D.	132	124	5	135
ENGINEERING	N	2723	116	19	2858
	MEAN	654	622	645	652
	S.D.	104	111	69	105
MATH SCIENCE	N	622	165	5	792
	MEAN	684	638	584	659
	S.D.	112	101	105	111
PHYSICAL SCIENCE	N	592	110	4	706
	MEAN	635	599	603	629
	S.D.	124	119	118	124
NOT IN ABOVE	N	183	85	2	270
	MEAN	540	542	570	541
	S.D.	137	139	80	137
UNDECIDED	N	500	248	5	753
	MEAN	590	557	462	578
	S.D.	146	147	127	147
NO RESPONSE	N	253	95	3	351
	MEAN	579	541	527	568
	S.D.	152	154	109	153
TOTAL	N	8235	2856	81	11172
	MEAN	592	523	542	574
	S.D.	141	143	143	145

GRE-A MEAN, S.D. AND NUMBER OF MALE AND FEMALE STUDENTS BY GRADUATE MAJOR AREAS

Foreign ESL

GRADUATE MAJOR		MALE	FEMALE	NO RESPONSE	TOTAL
ARTS	N	59	64	0	123
	MEAN	355	339	0	347
	S.D.	109	96	0	103
OTHER HUMANITIES	N	410	423	4	837
	MEAN	372	399	373	386
	S.D.	111	109	52	111
EDUCATION	N	256	264	4	524
	MEAN	309	351	288	330
	S.D.	93	107	94	102
SOCIAL SCIENCE	N	584	277	12	873
	MEAN	358	374	313	362
	S.D.	111	116	117	113
BEHAVIORAL SCIENCE	N	1161	533	12	1706
	MEAN	386	399	367	390
	S.D.	122	114	65	119
BIOLOGICAL SCIENCE	N	371	201	5	577
	MEAN	374	396	318	381
	S.D.	118	115	65	117
HEALTH	N	284	221	4	509
	MEAN	368	369	350	368
	S.D.	107	112	154	110
APPLIED BIOLOGY	N	237	54	2	293
	MEAN	341	379	265	348
	S.D.	105	109	55	107
ENGINEERING	N	2723	116	19	2858
	MEAN	398	406	344	398
	S.D.	109	113	92	109
MATH SCIENCE	N	622	165	5	792
	MEAN	411	393	326	407
	S.D.	114	98	174	112
PHYSICAL SCIENCE	N	592	110	4	706
	MEAN	394	384	360	392
	S.D.	116	114	122	116
NOT IN ABOVE	N	183	85	2	270
	MEAN	349	371	400	356
	S.D.	113	89	80	107
UNDECIDED	N	500	248	5	753
	MEAN	372	387	326	376
	S.D.	116	108	80	115
NO RESPONSE	N	253	95	3	351
	MEAN	368	394	430	376
	S.D.	114	110	57	113
TOTAL	N	8235	2856	81	11172
	MEAN	382	385	341	383
	S.D.	115	111	105	114

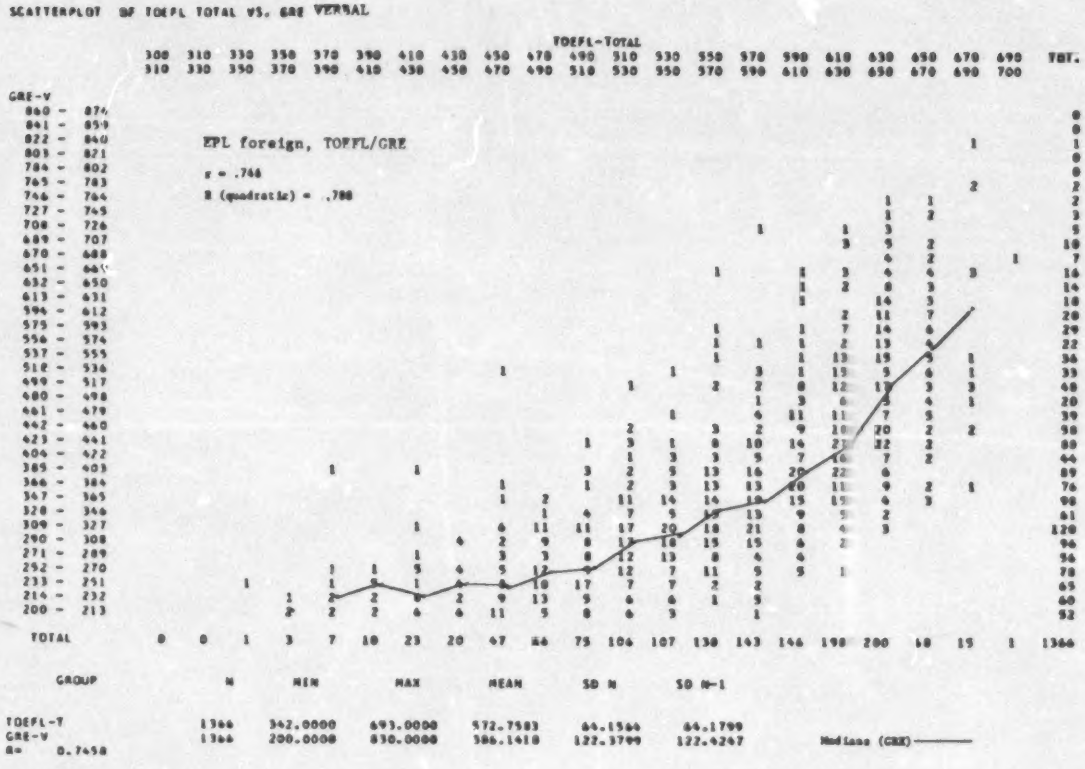
A.6. GRE Aptitude Test Statistics for foreign ESL candidates, 1977-78: By sex and intended graduate area of study

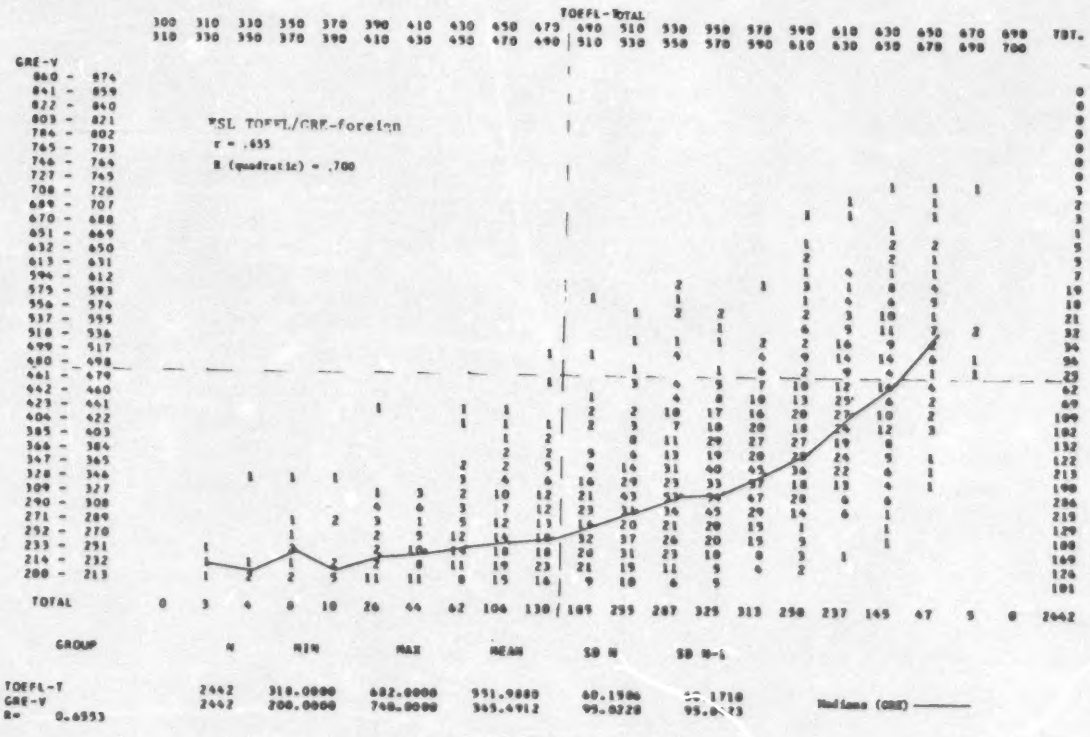
Appendix B

B.1 Scatterplots of GRE verbal and TOEFL total scores of foreign EPL and ESL subgroups, respectively

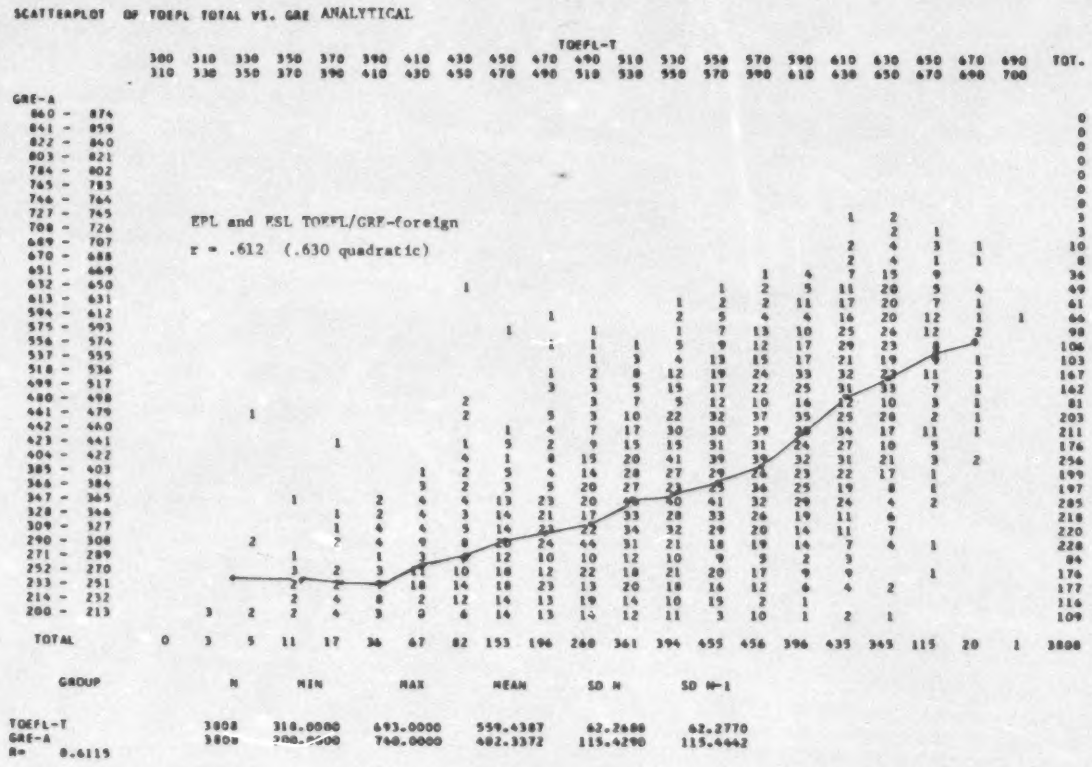
B.2 Scatterplot of GRE analytical and TOEFL total scores for combined EPL and ESL samples

B.3 Scatterplot of GRE verbal and TOEFL total scores in a sample of TOEFL candidates volunteering to take GRE verbal

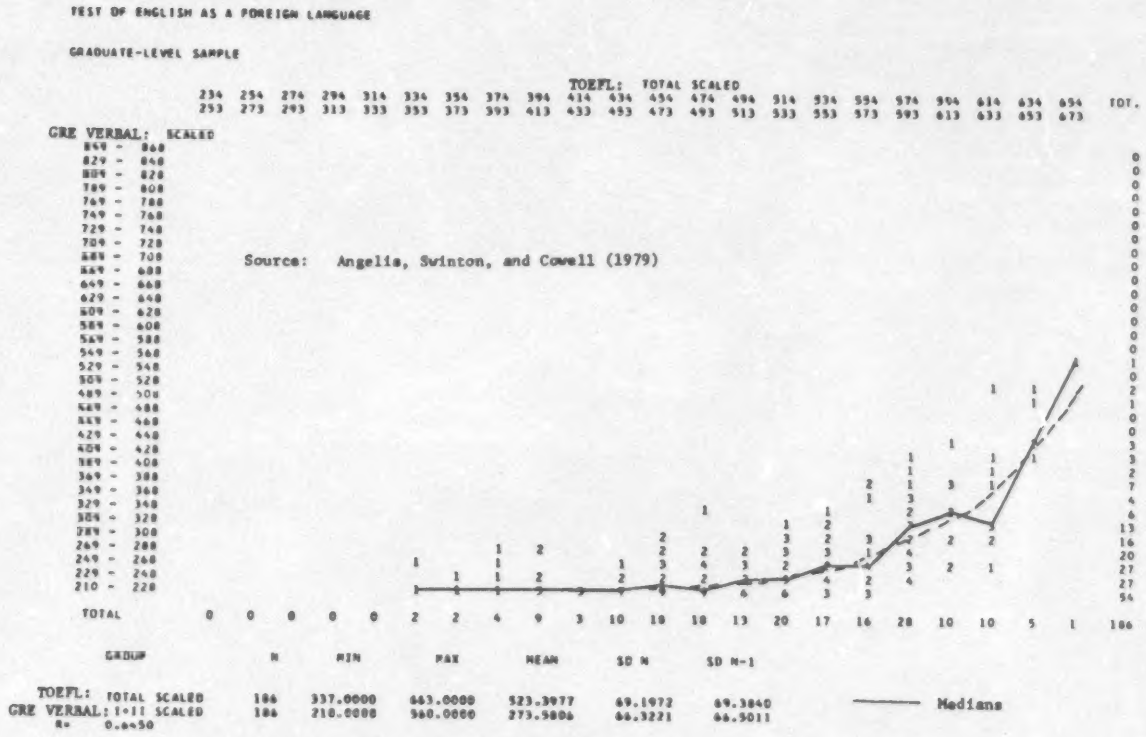




B.1. Scatterplots of GRE-Verbal and TOEFL Total scores of foreign EPL and ESL subgroups


SCATTERPLOT OF TOEFL TOTAL VS. GRE ANALYTICAL
TOEFL-T
GRE-A
EPL and ESL TOEFL/GRE-foreign
r = .612 (.630 quadratic)
TOTAL
GROUP N MIN MAX MEAN SD N SD N-1
TOEFL-T 3808 310.0000 693.0000 559.4387 62.2688 62.2770
GRE-A 3808 200.0000 740.0000 482.3372 115.4290 115.4442
R= 0.6115

B.2. Scatterplot of GRE Analytical and TOEFL Total scores for combined EPL and ESL samples


TEST OF ENGLISH AS A FOREIGN LANGUAGE
GRADUATE-LEVEL SAMPLE
TOEFL: TOTAL SCALED
GRE VERBAL: SCALED
Source: Angelis, Swinton, and Cowell (1979)
TOTAL
GROUP N MIN MAX MEAN SD N SD N-1
TOEFL: TOTAL SCALED 186 337.0000 663.0000 523.3977 69.1972 69.3840
GRE VERBAL: SCALED 186 210.0000 560.0000 373.5806 86.3221 86.5011
R= 0.6450
Medians

B.3. Scatterplot of GRE-Verbal and TOEFL Total scores in a sample of TOEFL candidates volunteering to take GRE-Verbal

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Report 9. *Item Performance Across Native Language Groups on the Test of English as a Foreign Language.* Donald L. Alderman and Paul W. Holland. August 1981.

Report 10. *Language Proficiency as a Moderator Variable in Testing Academic Aptitude.* Donald L. Alderman. November 1981.

Report 11. *A Comparative Analysis of TOEFL Examinee Characteristics, 1977-1979.* Kenneth M. Wilson. September 1982.

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